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SELECTED WATER RESOURCES ABSTRACTS

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VOLUME 10, NUMBER 12
JUNE 15, 1977

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 10, NUMBER 12
JUNE 15, 1977

W77-05601 -- W77-06100

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
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03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
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06 WATER RESOURCES PLANNING
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08 ENGINEERING WORKS
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09 MANPOWER, GRANTS, AND FACILITIES
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

EFFECTS OF ANTECEDENT SOIL MOISTURE ON STORM HYDROGRAPHS,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. A. Lynch.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 868, Price codes: A08 in paper copy, A01 in microfiche. Ph.D. Thesis, November 1976. 141 p., 16 tab., 35 fig., 26 ref., 1 append. OWRT B-028-PA(4), 14-31-0001-3124.

Descriptors: *Simulated rainfall, *Forest watersheds, *Soil moisture, Irrigation systems, Peak discharge, Field capacity, Storm runoff, Hydrographs, Simulation analysis.
Identifiers: *Antecedent soil moisture, *Storm hydrograph, Antecedent flow rate, Quickflow, Delayed flow, Total storm runoff, Time to peak, Time of recession, Duration of quickflow.

Effects of antecedent soil moisture on size and shape of storm hydrographs were studied by applying simulated rainfall to a forested watershed. An irrigated system distributed water pumped from a lake for the simulated rainstorms. Soil moisture content was determined. Eight simulated rainstorms were replicated at various antecedent soil moisture contents under similar climatic conditions. The resulting hydrographs were compared. Relationships were determined between these storm hydrograph parameters and antecedent soil moisture and antecedent flow rate. Increasing antecedent soil moisture had a profound effect on all the characteristics and components of the storm hydrograph, except delayed flow. Quickflow, total storm runoff, and maximum peakflow increased with antecedent moisture content while time to peakflow, time of recession, and duration of quickflow varied. Major changes in the size and shape of the storm hydrograph only occurred when antecedent soil moisture was above 87 percent field capacity. Below this field capacity, only minor changes in the size and shape of the storm hydrograph occurred. Antecedent flow rate was a very good indicator of average soil moisture conditions on the study basin. (Sink-Penn State)
W77-05603

A STOCHASTIC APPROACH TO SPACE-TIME MODELING OF RAINFALL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
V. K. Gupta.
Available from the National Technical Information Service Springfield, VA 22161 as PB-264 836, Price codes: A08 in paper copy, A01 in microfiche. Reports on Natural Resource Systems, Report No. 18, June 1973. 154 p, 12 fig, 2 tab, 56 ref, 2 append. (Constitutes the Ph.D. dissertation of the same title completed in May, 1973.) OWRT B-032-ARIZ(12), 14-31-0001-3858.

Descriptors: *Rainfall intensity, *Precipitation excess, Storms, *Arizona, *Stochastic processes, Model studies, *Design storm, Southwest US, Watersheds(Basins), *Distribution patterns.
Identifiers: *Design rainfall, *Atterbury watshed(Ariz), *Space-time modeling(Rainfall).

This study gives a phenomenologically based stochastic model of spacetime rainfall. Specifically, two random variables on the spatical rainfall, i.e. the cumulative rainfall within a season and the maximum cumulative rainfall per rainfall event within a season are considered. An approach is given to determine the cumulative distribution function (c.d.f.) of the cumulative rainfall per event, based on a particular random structure of space-time rainfall. Then the first two moments of the cumulative seasonal rainfall are derived based on a stochastic dependence between the cumulative rainfall per event and the number of rainfall events within a season. This stochastic dependence is important in the context of the spatial rainfall process. A theorem is then proved on the rate of convergence of the exact c.d.f. of the seasonal cumulative rainfall up to the ith year, i = or > 1, to its limiting c.d.f. Use of the limiting c.d.f. of the maximum cumulative rainfall per rainfall event up to the ith year within a season is given in the context of determination of the 'design rainfall'. Such information is useful in the design of hydraulic structures. Special mathematical applications of the general theory are developed from a combination of empirical and phenomenological based assumptions. A numerical application of this approach is demonstrated on the Atterbury watershed in the Soutwestern United States.
W77-05730

COMPUTER SIMULATION OF SNOWMELT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2C.
W77-05735

ELECTRIC ANALOG SIMULATION OF THE AQUIFERS ALONG THE SOUTH COAST OF PUERTO RICO,
Water Resources Div. Reston, Va. Geological Survey.
For primary bibliographic entry see Field 2F.
W77-05746

ON THE DERIVATION OF LINKAGE EQUATIONS FOR LAGUERRE FUNCTION COEFFICIENTS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2B.
W77-05794

MATHEMATICAL MODELS FOR THE SIMULATION OF CYCLONIC STORM SEQUENCES AND PRECIPITATION FIELDS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 2B.
W77-05795

A DESCRIPTIVE CATALOGUE OF THE AUSTRALIAN REPRESENTATIVE BASINS 1975.
Department of National Resources, Canberra (Australia).
For primary bibliographic entry see Field 4D.
W77-05816

AN APPLICATION OF THE UTAH STATE UNIVERSITY WATERSHED SIMULATION MODEL TO THE ENTIAT EXPERIMENTAL WATERSHED, WASHINGTON STATE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W77-05918

HYDROLOGY FOR SOIL AND WATER CONSERVATION IN THE COASTAL REGIONS OF NORTH AFRICA--EXAMPLE OF A HYDROLOGICAL TECHNIQUE FOR SMALL BASINS,
Soil Conservation Service, Washington, D.C. Engineering Div.
For primary bibliographic entry see Field 3B.
W77-05945

RAINFALL INFILTRATION CHARACTERISTICS FOR A SEMI-ARID WATERSHED SOIL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2G.
W77-05988

EXTENDED PERIOD SIMULATION OF WATER SYSTEMS--PART B,
Systems Control, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 4A.
W77-05996

MULTISTATION, MULTIYEAR SYNTHESIS OF HYDROLOGIC TIME SERIES BY DISAGGREGATION,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
P. C. Tao, and J. W. Delleur.
Water Resources Research, Vol. 12, No. 6, p 1303-1312, December 1976. 5 fig, 3 tab, 19 ref. OWRT B-036-IND(15).

Descriptors: *Rainfall, *Ohio River, *Mississippi River, *Runoff, *Model studies, Mathematical models, Time series analysis, Rainfall-runoff relationships, Streams, Graphical analysis, Tributaries, Basins, Correlation analysis, Watersheds(Basins), Hydrology.

A model was presented which is designed for multivariate (multistation, multiyear) data syntheses, such as the simulation of several rainfall series over a region, of tributaries and mainstream runoff series, and of rainfall and concurrent runoff series in watersheds. The model was an application of the disaggregation scheme proposed by Valencia and Schaake. If a time series of higher-level (e.g., annual) events for each station has been generated by some scheme which preserves the long-term properties, then the disaggregation model can be used to generate parallel time series of lower-level (e.g., monthly, weekly) events for each corresponding station. The aggregation of the generated lower-level sequences can preserve the long-term properties of the original higher-level series. The seasonal variations, the means, the variances, the autocovariances, and the cross-covariances, properties of the original lower-level time series, are also conserved. The lower-level generated series also preserves the correlations between stations. The generation of multivariate normal random numbers makes use of either the Crout factorization or the principal component analysis, depending on whether the covariance matrix of the lower-level series is positive definite or positive semidefinite, respectively. A technique for modeling non-normal residual components was discussed. The model was applied to 36 rainfall runoff, and rainfall-runoff sequences in the lower Ohio and upper Mississippi River basins located in Indiana, Illinois, Ohio, and Kentucky. The properties of the generated data series show excellent agreement with those of the historical observed data series. (Sims-ISWS)
W77-06008

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN ENVIRONMENTAL DISPERSION MODELS,
Cleveland State Univ., Ohio.
F. M. Galloway, Jr.
Water Resources Research, Vol. 12, No. 5, p 933-940, October 1976. 12 fig, 1 tab, 16 ref. OWRT A-036-OHIO(2).

Descriptors: *Dispersion, *Flow, *Model studies, Mathematical models, Lakes, Rivers, Estuaries, Atmosphere, Computer models, Water transfer, Circulation, Movement, Water circulation.
Identifiers: *Dispersion models.

Vertical averaging, or averaging in a plane perpendicular to the mean flow, in environmental dispersion problems is desirable from the standpoint of the efficiency of computer solution. A method is presented, based on computer solution of a model transport problem, for estimating when cross-plane averaging is appropriate. The method was applied to four examples, representing typical lakes, rivers, estuaries, and the atmosphere, respectively. The results were correlated in terms of a characteristic length, velocity, and turbulent diffusivity, and two dimensionless parameters that depend on the velocity and vertical diffusivity profiles. It was shown that these parameters vary over a relatively small range for the variety of examples that are considered. (Sims - ISWS)
W77-06010

2B. Precipitation

A STOCHASTIC APPROACH TO SPACE-TIME MODELING OF RAINFALL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2A.
W77-05730

COMPOSITION OF SELECTED RAIN SAMPLES COLLECTED AT MENLO PARK, CALIFORNIA IN 1971,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05754

ON THE DERIVATION OF LINKAGE EQUATIONS FOR LAGUERRE FUNCTION COEFFICIENTS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
M. H. Diskin.
Journal of Hydrology, Vol. 32, No. 3/4, p 321-327, February 1977. 3 ref.

Descriptors: *Hydrograph analysis, *Unit hydrographs, *Precipitation excess, *Storm runoff, Analytical techniques, Methodology, Hydrology, Rainfall-runoff relationships, Mathematical studies.
Identifiers: *Laguerre functions, Orthonormal functions, Convolution integral, Linkage equation.

The relationship among the three functions: the rainfall excess, the instantaneous unit hydrograph, and the direct surface runoff was given by the convolution integral in the case of a linear system. In analysis of linear runoff systems, the most common problem is the identification of the impulse response function, or instantaneous unit hydrograph. One method of solving this problem involves representing the three functions as weighted sum of orthonormal functions for which the coefficients can be determined easily. The procedure is simplified by using Laplace transforms of these functions. The laguerre functions are a set of time functions which are orthonormal over the range of positive values of their variable time. The three sets of coefficients for the three functions are related to each other by Linkage equations that enable the solution for one set when the other two are known. Complete derivation of the linkage equation was presented. (Singh-ISWS).c
W77-05794

MATHEMATICAL MODELS FOR THE SIMULATION OF CYCLONIC STORM SEQUENCES AND PRECIPITATION FIELDS,
California Univ., Davis. Dept. of Water Science and Engineering.
J. Amorocho, and B. Wu.
Journal of Hydrology, Vol. 32, No. 3/4, p 329-345, February 1977. 10 fig, 2 tab, 21 ref.

Descriptors: *Mathematical models, *Simulated rainfall, *California, *Simulation analysis, *Cyclones, Storms, Radar, Storm water, Storm structure, Storm runoff, *Precipitation(Atmospheric), Monte Carlo method.

Ground records and radar imagery show that many cyclonic-storm systems observed in northern California have distinct storm-band structures, and that each band is composed of clusters of short-lived rain cells. Based on this information, two mathematical models were developed for the simulation of cyclonic-storm precipitation fields. A storm-sequence model, based on the Monte Carlo simulation technique, generated storm sequences from the probability distributions of storm characteristics of historical sequences. The analysis included time between storms, number of bands within a storm, time between bands, band duration, band depth, and band velocity. The second model simulated a spatially distributed precipitation field by using a randomization process to generate clusters of short-lived and high-intensity rain cells within a storm band. The apparent sizes, life cycles, and space distribution of rain cells were determined from the properties of historical data. The two models can be used together or in a succession to generate precipitation sequences for any sampling time interval and at any ground location in the path of a storm. The application of these models in urban hydrology was discussed. (Roberts-ISWS)
W77-05795

SEASONAL VARIATION OF ICHTHYOPLANKTON IN THE ARABIAN SEA IN RELATION TO MONSOONS,
Indian Ocean Biological Centre, Cochin (India); and National Inst. of Oceanography, Cochin (India).
For primary bibliographic entry see Field 2L.
W77-05843

DYNAMICS OF DESERTS AND DROUGHT IN THE SAHEL,
Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
For primary bibliographic entry see Field 2D.
W77-05943

COMMENT ON THE PAPER 'DYNAMICS OF DESERTS AND DROUGHT IN THE SAHEL' BY J. G. CHARNEY, (AND REPLY),
Saskatchewan Univ., Saskatoon. Dept. of Plant Ecology; and Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
For primary bibliographic entry see Field 2D.
W77-05944

NUMERICAL SIMULATION OF THE OROGRAPHICALLY INDUCED PRECIPITATION DISTRIBUTION FOR USE IN HYDROLOGIC ANALYSIS,
National Weather Service, Sacramento, Calif. River Forecast Center.
D. E. Colton.
Journal of Applied Meteorology, Vol. 15, No. 12, p 1241-1251, December 1976. 11 fig, 1 tab, 10 ref.

Descriptors: *Precipitation(Atmospheric), *Orography, *Spatial distribution, *Model studies, *Mathematical models, Numerical analysis, Mountains, Rainfall, Analysis, Snowfall, Floods, Flood forecasting, Simulation analysis, Cloud physics, Weather, Meteorology.
Identifiers: *Sierra Nevada Mountains.

A fine-mesh mesoscale numerical model was used to simulate the orographic precipitation process for the purpose of improving estimates of the spatial distribution of precipitation in mountainous areas. Results from integrations of a quasi-two-dimensional version of the model suggested that the orographic precipitation process can be simulated with sufficient accuracy to justify the use of fine-mesh numerical models to aid in the determination of the spatial distribution of precipitation in mountainous areas where orographic influences are dominant. (Sims - ISWS)
W77-05974

RAINFALL RESULTS, 1970-1975: FLORIDA AREA CUMULUS EXPERIMENT,
National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
For primary bibliographic entry see Field 3B.
W77-05975

THE 1974 SKYWATER WORKSHOP,
RAND Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 3B.
W77-05976

RAINFALL INFILTRATION CHARACTERISTICS FOR A SEMI-ARID WATERSHED SOIL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2G.
W77-05988

SURGE EFFECTS FROM HURRICANE ELOISE,
Army Engineer District, Mobile, Ala. Navigation and Coastal Branch.
For primary bibliographic entry see Field 2L.
W77-06085

2C. Snow, Ice, and Frost

COMPUTER SIMULATION OF SNOWMELT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
R. M. Solomon, P. F. Ffolliott, M. B. Baker, Jr., and J. R. Thompson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 109, Price codes: A02 in paper copy, A01 in microfiche. U.S.D.A. Forest Service, Research Paper RM-174, Rocky Mountain Forest and Range Experiment Station, October 1976, 8 p. 5 fig, 16 ref. append. OWRT A-042-ARIZ(13). 14-31-0001-3803.

Descriptors: *Computer models, *Snowmelt, *Simulation analysis, *Arizona, Air temperature, Solar radiation, Precipitation(Atmospheric), Cloud cover, Forest watersheds, Model studies, *Computer programs, *Runoff forecasting, Watershed management.
Identifiers: *Intermittent snowpacks, Shortwave radiation, Model verification.

A modification of a previously developed computer model of snowmelt provides for modeling intermittent snowpacks, and is believed to be a more generalized model than the original program. The modified program SNOWMELT is dependent on four daily input variables--maximum and minimum temperatures, precipitation, and shortwave radiation or percent cloud cover. Initializing the model requires limited knowledge of local watershed and snowpack parameters. Model verification on seven experimental watersheds in Arizona proved satisfactory. (White-Arizona)
W77-05735

ICINGS ALONG THE TRANS-ALASKA PIPELINE ROUTE,
Geological Survey, Anchorage, Alaska. Water Resources Div.
C. E. Sloan, C. Zenone, and L. R. Mayo.
Available from the Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA. 22202, price $1.05. Proffessional Paper 979, 1976. 31 p, 32 fig, 9 ref.

Descriptors: *Ice, *Pipelines, *Alaska, *Oil industry, *Flood plains, Seepage, Groundwater, Melt water, Erosion, Aerial photography, Mapping, Evaluation.
Identifiers: *Trans-Alaska Pipeline, *Pipeline icing effects.

The location and extent of icings observed during six winters, 1969 to 1974, along the trans-Alaska pipeline route are shown on a series of maps and photographs. Large flood-plain icings occur in the braided river channels of the Sagavanirktok, Atigun, Dietrich, and Delta Rivers. Numerous lesser stream and hillside icings also occur along the pipeline route. Construction of the pipeline, roads, pumping stations, and training structures will displace some existing icings and will create new icings. Icings may cause problems such as flooding and erosion when they form on or near the pipeline, roads, and other pipeline facilities. (Woodard-USGS)
W77-05741

VOLUMETRIC CHANGE OF THE ATHABASCA GLACIER OVER THE LAST 100 YEARS,
Ontario Ministry of the Environment, Ottawa. Water Resources Branch.
G. W. Kite, and I. A. Reid.
Journal of Hydrology, Vol. 32, No. 3/4, p 279-294, February 1977. 8 fig, 17 ref.

Descriptors: *Glaciers, *Volume, *Canada, *Arctic, Glacial drifts, Geomorphology, Bedrock, Movement, Size, Ice, Ablation, Geology, Glaciology.
Identifiers: *Athabasca Glacier(Alberta).

Existing data from radio-interferometry; photogrammetry; drill holes; and seismic, elctrical, gravity, and radar surveys were combined to estimate the shape and volume of the present Athabasca Glacier. On the evidence of dated lateral moraines and extrapolations of glacier surface contours, an estimate of the volume of the glacier at its recent maximum in 1870 was made. Results show that the volume of the present ablation zone of the glacier is about 2/3 of its 1870 volume. The implications of this change were discussed. (Sims-ISWS)
W77-05792

RHEOLOGICAL IMPLICATIONS OF THE INTERNAL STRUCTURE AND CRYSTAL FABRICS OF THE WEST ANTARCTIC ICE SHEET AS REVEALED BY DEEP CORE DRILLING AT BYRD STATION,
Cold Regions Research and Engineering Lab., Hanover, N. H.
A. J. Gow, and T. Williamson.
Geological Society of America Bulletin, Vol. 87, No. 12, p 1665-1677, December 1976. 11 fig, 51 ref.

Descriptors: *Ice, *Glaciers, *Antarctic, Crystals, Core logging, Core drilling, Analytical techniques, Volcanoes, Cold regions, Glaciology, Borehole geophysics, Rheology.
Identifiers: *Byrd Station(Antarctica), Ice cores, Ice crystals, Ice sheets, Ice crystal studies.

Crystalline textures and fabrics of ice cores from the 2164-m-thick ice sheet at Byrd Station, Antarctica, reveal the existence of an anisotropic ice sheet. A gradual but persistent increase in the c-axis preferred orientation of the ice crystals was observed between the surface and a depth of 1200 m. This progressive growth of an oriented crystal fabric is accompanied by a twenty-fold increase in crystal size between 56 and 600 m, followed by virtually no change in crystal size between 600 and 1200 m depth. A broad vertical clustering of c axes develops by 1200 m. Between 1200 and 1300 m, the structure transforms into a fine-grained mosaic of crystals, with their basal glide planes now oriented substantially within the horizontal. This highly oriented fine-grained structure, which persists to 1800 m depth, is compatible only with a strong horizontal shear deformation in this part of the ice sheet. Rapid transformation from single-to multiple-maximum fabrics occurs below 1800 m. This transformation, accompanied also by the growth of very large crystals, is attributed to the overriding effect of relatively high temperatures in the bottom layers of old ice at Byrd Station rather than to a significant decrease in stress. The zone of single-maximum fabrics between 1200 and 1800 m also contains numerous layers of volcanic dust. Fabrics of the very fine grained ice associated with these dust bands indicate that the bands are actively associated with shearing in the ice sheet. (Sims-ISWS)
W77-05798

RECUMBENT FOLDING IN THE BASE OF THE BARNES ICE CAP, BAFFIN ISLAND, NORTHWEST TERRITORIES, CANADA,
Minnesota Univ., Minneapolis. Dept. of Geology and Geophysics.
P. J. Hudleston.
Geological Society of America Bulletin, Vol. 87, No. 12, p 1684-1692, December 1976. 9 fig, 31 ref. NSF GA-19310, GA-42728.

Descriptors: *Glaciers, *Ice, *Canada, On-site investigations, Model studies, Mathematical models, Crystals, Geomorphology, Cold regions, Glaciology.
Identifiers: *Barnes Ice Cap(Baffin Island), Recumbent folds, Glacier folding.

Recumbent folds exposed in an ice cliff at the southeast side of the Barnes Ice Cap occur in banded ice and have hinges subparallel to the glacier margin. The folds appear similar in shape and attitude to others expressed on the glacier surface as a series of irregular lenses of white ice that are elongate parallel to the margin and are surrounded by blue ice. Such lenses are all around the margin of the south dome of the ice cap. Both sets of folds are thought to have a common origin. Fold geometry and fabric studies suggest that the ice is behaving homogeneously on the scale of the folds and that the banding is essentially passive. Flow considerations indicate that banding or foliation will tend to become parallel to the particle paths near the glacier base and toward the margin under steady-state conditions. However, departures from the steady-state in the form of minor advances or retreats may change the flow pattern sufficiently for the particle paths to depart from parallelism with the banding, which may then become passively deformed and eventually folded. For this to occur, the bedrock surface must be appropriately irregular. A simple mathematical model described this process and successfully accounted for the geometrical features of the folds observed. This theory was consistent with earlier observations of the Barnes Ice Cap which suggest that there have been fluctuations in the position of the ice-cap margin in the last few centuries. (Sims-ISWS)
W77-05799

ALTERNATE METHODS OF AVALANCHE CONTROL (INTERIM) (1974-1975),
Washington Univ., Seattle. Geophysics Program; and Washington Univ., Seattle. Dept. of Civil Engineering.
E. R. LaChapelle, C. B. Brown, R. J. Evans, J. B. Johnson, and J. A. Langdon.
Available from the National Technical Information Service, Springfield VA 22161 as PB-247 274, Price codes: A08 in paper copy, A01 in microfiche. Washington State Highway Commission, Department of Highways, Olympia, Research Program Report 19.1, July 1975. 158 p, 57 fig, 4 tab, 5 ref, 3 append.

Descriptors: *Avalanches, *Snow management, *Snow, *Washington, Snowpacks, Snow cornice, Hazards, On-site investigations, Equipment, Vibrations, Interfaces, Snow cover, Meteorology, Weather modification.
Identifiers: *Avalanche control, Air bags, Gas exploders.

This interim report summarized results from the first year of investigation into alternate methods of avalanche control. This research project was designed to seek methods of either preventing or artificially releasing snow avalanches. The methods sought were not to depend on the conventional application of high explosives or the use of artillery. Four different methods of controlling snow avalanches are being investgated. These are: (1) artificial release by inflation of air bags under the snow; (2) artificial release by exploding a gas-oxygen mixture in special containers placed under the snow (gas exploders); (3) artificial release by initiating fracturing in snow through vibration; and (4) modification of the snow-earth interface, either to inhibit avalanche formation (in the conventional sense of avalanche defense structures) or to enhance avalanching and prevent build-up of dangerous amounts of snow. During the first winter, strong emphasis was placed on design and field-testilng of the air bag and gas exploder system. Fundamental studies are being carried out on sound transmission and mechanical resonance in snkow as a background for the vibration method. Interface modification was treated during the first year at the theoreticl level, except for some very minor field tests. (Sims-ISWS)
W77-05810

ICE ENGINEERING IN SMALL CRAFT MARINAS, AN ANNOTATED BIBLIOGRAPHY,
Wisconsin Univ.-Parkside, Kenosha. Dept. of Engineering Science.
J. P. Zarling.
Available from the National Technical Information Service, Springfield VA 22161 as PB-246 599, Price codes: A07 in paper copy A01 in microfiche. NOAA Sea Grant Advisory Report No. 8, WIS-SG-74-408, November 1974. 128 p.

Descriptors: *Bibliographies, *Marinas, *Ice, *Reviews, *Harbors, Ice cover, Lakes, Lake ice, Iced lakes, Sea ice, Boats, Recreation facilities, Ice jams, Ice loads, Damages, Structures, Civil engineering.
Identifiers: *Small craft marinas, *Ice prevention, Ice formation, Annotated bibliography.

This annotated bibiography is the result of a study that was done on all facets of marina operation confrontd with ice problems. The first stage of this study was the appointment of an Advisory Committee made up of representatives from educational institutions, governmental agencies, and the marina industry. The Committee identified three specific problem areas in which applied research was needed: vertical ice forces on piles, horizontal ice forces on piles, and ice preention/suppression techniques. The second stage of the study was the production of this bibliography, in which is assembled available information related to ice engineering in small craft marinas. The bibliogrpahy contains over 400 references, with annotations given for the majority of the entries were selected from a literature search conducted between September 1973 and August 1974. The annotations are abstracts, condensations, or direct quotess from the individual papers or from previous bibliographic publications. The enteries are listed alhabetically by author. There is a subject index which will aid in finding previously published literature related to similar research or design interests. (Sims-ISWS)
W77-05812

SEASONAL STREAMFLOW ESTIMATION IN THE HIMALAYAN REGION EMPLOYING METEOROLOGICAL SATELLITE SNOW COVER OBSERVATIONS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
A. Rango, V. V. Salomonson, and J. L. Foster.
Water Resources Research, Vol. 13, No. 1, p 109-112, February 1977. 3 fig, 1 tab, 7 ref. NOAA NA-776-74.

Descriptors: *Remote sensing, *Snow cover, *Runoff, *Streamflow forecasting, Satellites(Artificial), Flow, Rivers, Water resources, Regression analysis, Correlation analysis, Snowmelt, Watersheds(Basins), Snow, Hydrology, Meteorology.
Identifiers: *Himalayan Region, *Indus River(Pakistan), *Kabul River(Pakistan), *Pakistan.

Low-resolution meteorological satellite data and simple photo interpretation techniques were used to map snow-covered areas during early April over the Indus River and Kabul River basins in Pakistan. The early spring snow-covered area was significantly related to April 1 through July 31 streamflow in regression analyses for each watershed (Indus River, 1969-1973, r squared = 0.89, and Kabul River, 1967-1973, r squared = 0.89). Predictions of 1974 seasonal streamflow, using the regression equations, were within 7% of the actual 1974 flow. Because of inadequate hydrometeorological data, conventionally based streamflow predictions are not possible in some of these remote regions, and the satellite-derived runoff estimates have immediate applicability for improved water resources management. (Sims-ISWS)
W77-05956

SYNTHESIS OF SNOWMELT RUNOFF HYDROGRAPHS,
Nevada Univ., Reno. Desert Research Inst.; and Nevada Univ., Reno. Dept. of Civil Engineering.
A. B. Cunningham.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY1, Proceedings Paper 12668, p 51-67, January 1977. 10 fig, 4 tab, 9 ref, 3 append. OWRT A-055-NEV(2).

Descriptors: *Snowmelt, *Runoff, *Hydrographs, *Nevada, *Model studies, Mathematical models, Design flood, Snowpacks, Streamflow, Temperature, Melting, Travel time, Hydrograph analysis, Water sources, Hydrography, Hydraulics.
Identifiers: *Hydrograph synthesis, *Sierra Nevada basins.

A generalized procedure was suggested for synthesis of snowmelt runoff hyrographs, exclusive of the effects of incident rainfall, for use in regions with limited hyrologic data. This procedure, referred to as the Dimensionless Snowmelt Hydrography (DSH) , incorporates a hydrograph profile for at least one runoff event directly in the methodology. Basic data requirements include mean daily temperature and streamflow, along with representative water equaivalent values for the drainage basin. Examples of applications to severval Sierra Nevada basins were analyzed, and limitations of the procedure were considered. (Sims-ISWS)
W77-06000

ON THE POSSIBILITY OF ACCLIMATIZATION OF TILAPIA NILOTICA TO LOW WATER TEMPERATURE CONDITION, (IN JAPANESE),
For primary bibliographic entry see Field 2I.
W77-06033

2D. Evaporation and Transpiration

PHYSIOLOGICAL EFFECT OF TRIAZINE HERBICIDES ON TYPHA LATIFOLIA L.,
Polish Academy of Sciences, Mikolajki (Poland). Lab. of Chemical Ecology.
For primary bibliographic entry see Field 5C.
W77-05861

DYNAMICS OF DESERTS AND DROUGHT IN THE SAHEL,
Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
J. G. Charney.
Quarterly Journal of the Royal Meteorological Society, Vol. 101, No. 428, p 193-202, April, 1975. 7 fig, 3 ref.

Descriptors: *Deserts, *Arid lands, *Albedo, *Droughts, *Africa, *Radiation, Subtropic, Environment, Drying, Climatology, Precipitation(Atmospheric), Vegetation effects, Rainfall, Desert plants, Evaporation, *Mathematical models.
Identifiers: *Sahel, *Hadley circulation.

It is suggested that the high albedo of a desert contributes to a net radiative heat loss relative to its surroundings and that the resultant temperature gradients induce a frictionally controlled circulation importing heat aloft and maintaining thermal equilibrium through sinking motion and adiabatic compression. In the subtropics this sinking motion is superimposed on the descending branch of the mean Hadley circulation but is more intense. Relative humidity decreases and the desert enhances its own dryness, feeding back upon itself in an important manner. To estimate the self-inductive effect of the desert relative to that of the Hadley circulation, a mathematical model of flow over the Sahara was constructed. Taking into account the biosphere, the feedback mechanism could conceivably lead to instabilities or metastabilities in desert regions. It is argued that a reduction of vegetation with consequent increase in albedo in the Sahel would perpetuate the arid conditions. Numerical integrations appear to substantiate this hypothesis. (See also W77-05944) (Jamail-Arizona)
W77-05943

COMMENT ON THE PAPER 'DYNAMICS OF DESERTS AND DROUGHT IN THE SAHEL' BY J. G. CHARNEY, (AND REPLY),
Saskatchewan Univ., Saskatoon. Dept. of Plant Ecology; and Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
E. A. Ripley, and J. Charney.
Quarterly Journal of the Royal Meteorological Society, Vol. 102, No. 432, p 466-468, April, 1976. 9 ref.

Descriptors: *Albedo, *Vegetation effects, *Deserts, *Droughts, Subtropic arid lands, *Africa, *Radiation, Environment, Drying, Precipitation(Atmospheric), Rainfall, Desert plants, Evaporation.
Identifiers: *Sahel, *Hadley circulation.

J.G. Charney's claim (Quarterly Journal of the Royal Meteorological Society, Vol. 101, No. 428, p 193-202, April, 1975, (see W77-05943) that the recent drought in the Sahelian zone of Africa can be at least partially blamed on overgrazing of the area by sheep and goats, and his argument that vegetation absorbs more solar radiation than desert, resulting in enhanced convections and greater rainfall over the vegetated areas is challenged. It is argued that vegetation requires a considerable amount of water, the evaporation of which would consume a large fraction of the available energy. Thus, on the basis of actual measurements and energy-balance considerations, including evaporation, one should expect enhanced daytime convection over desert areas compared with adjacent vegetated areas, that is a negative rather than a positive feedback effect as was proposed by Charney. Charney replies that Ripley misunderstood his argument, and he clarifies the points of misunderstanding. (Jamail-Arizona)
W77-05944

EVAPOTRANSPIRATION OF A DOUGLAS FIR DETERMINED WITH A WEIGHING LYSIMETER,
Washington Univ., Seattle. Coll. of Forest Resources.
L. J. Fritschen, J. Hsia, and P. Doraiswamy.
Water Resources Research, Vol. 13, No. 1, p 145-148, February 1977. 3 fig, 1 tab, 13 ref. NSF GB-36810X.

Descriptors: *Evapotranspiration, *Douglas fir trees, *Washington, Lysimeter, Precipitation, Irrigation, Evaporation, Interception, Soil moisture, Forestry, Dew.
Identifiers: *Weighing lysimeter, *Cedar River(Wash), Soil moisture depletion, Large plants, Interception studies, Plants, Hydrologic balance, Soil water content.

The evapotranspiration (ET) of a 28-m Douglas fir in a weighing lysimeter located on the Cedar River watershed near Seattle, Washington, was determined during the summer and fall of 1972, 1973, and 1974. Average ET rates from the area of the crown projection were 1.8 mm/d (55.8 l/d or 14/7 gal/d) in 1972, 2.0 mm/d in 1973, and 2.5 mm/d in 1974. The range for monthly periods was 1.3-3.6 mm/d. During 1972, ET was 46% of precipitation plus irrigation (P+I) and evaporation of interception (i) was 36% of ET. Comparable values for 1973 were 51% and 37%, and for 1974, comparable values were 69% and 24%. The lower ET/(P+I) values in 1973 and 1974 were associated with soil moisture depletion studies and longer periods of clear skies. The relatively high i/ET percentages suggests the need for more interception studies. Problems such as irrigation, drainage, listing, wind, rainfall interception, and the translation of data to an area basis that was associated with large plants in lysimeters were discussed. (Roberts-ISWS)
W77-05959

AN EVALUATION OF A RESISTANCE FORM OF THE ENERGY BALANCE TO ESTIMATE EVAPOTRANSPIRATION,
Kansas State Univ., Manhattan. Dept. of Agronomy.
J. L. Heilman, and E. T. Kanemasu.
Agronomy Journal, Vol. 68, No. 4, p 607-611 July-August 1976. 6 fig, 2 tab, 17 ref. OWRT A-056-KAN(4).

Descriptors: *Evapotranspiration, *Heat resistance, *Model studies, *Heat transfer, Momentum transfer, Latent heat, Lysimeters, Canopy, *Soybeans, *Sorghum.
Identifiers: *Energy balance, *Diffusion resistance.

A field study was conducted on soybean and sorghum in Kansas to evaluate an evapotranspiration model that uses diffusion resistance to heat transport (r sub H) in the energy-balance equation. Significant errors may occur if momentum resistance is used in the model instead of resistance for heat. Resistances were determined using wind speed and temperature profiles, and comparisons were made between latent-heat flux (LE) estimated using the model and by lysimetric measurements. Model estimates of LE using r sub H were within 4 and 15% of lysimetric measurements for soybean and sorghum, respectively. A model using air-diffusion resistance to momentum obtained estimates 25% greater for soybean and 10% greater for sorghum than those where heat resistance was used. The study indicates that thermal diffusion resistance is influenced by the aerodynamic behavior of a crop canopy, causing greater evapotranspiration from a flexible canopy than a rigid one. (Jahns-Arizona)
W77-05990

EFFECT OF THE SOIL WATER REGIME ON WATER EXCHANGE OF THE PEACH TREE, (IN RUSSIAN),
For primary bibliographic entry see Field 2G.
W77-06019

2E. Streamflow and Runoff

DISPERSION PROCESSES IN CIRCULAR OPEN-CHANNEL FLOWS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8B.
W77-05601

RIVER TURBINE,
For primary bibliographic entry see Field 4A.
W77-05660

FRICTION EFFECTS ON SPATIALLY VARIED OPEN CHANNEL FLOWS WITH INCREASING DISCHARGE,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-05674

THE INFLUENCE OF TURBULENCE ON STATIC AND TOTAL PRESSURE PROBES,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 8B.
W77-05676

A STUDY OF RUNOFF FROM SMALL RURAL WATERSHEDS IN RESPONSE TO COMPLETED AND PROPOSED LAND USE CHANGES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05728

WATER TEMPERATURES OF KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05743

FLOOD FREQUENCY--EXPECTED AND UNEXPECTED PROBABILITIES,
Water Resources Div. Reston, Va. Geological Survey.
For primary bibliographic entry see Field 4A.
W77-05747

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-05752

ON THE DERIVATION OF LINKAGE EQUATIONS FOR LAGUERRE FUNCTION COEFFICIENTS,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2B.
W77-05794

COMPUTATIONAL HYDRAULICS: A SHORT PATHOLOGY,
Danish Hydraulic Inst., Copenhagen. Computational Hydraulics Center.
For primary bibliographic entry see Field 8B.
W77-05797

A DESCRIPTIVE CATALOGUE OF THE AUSTRALIAN REPRESENTATIVE BASINS 1975.
Department of National Resources, Canberra (Australia).
For primary bibliographic entry see Field 4D.
W77-05816

APPLICATION OF A TRANSIENT FLOW MODEL TO COORDINATE URBAN STORM RUNOFF DATA WITH FLOW IN A RECEIVING RESERVOIR,
Tennessee Univ., Knoxville. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W77-05931

THE FISH POPULATIONS OF THE MIDDLE 340 KM OF THE WABASH RIVER,
DePauw Univ., Greencastle, Ind. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-05935

SHOT NOISE MODELS FOR THE GENERATION OF SYNTHETIC STREAMFLOW DATA,
Tel-Aviv Univ. (Israel). Dept. of Statistics.
G. Weiss.
Water Resources Research, Vol. 13, No. 1, p 101-108, February 1977. 1fig, 1 tab, 24 ref.

Descriptors: *Streamflow, *Synthetic hydrology, *Model studies, *Mathematical models, Stochastic processes, Hydrographs, Hydrologic data, Hydrology, Rivers, Flow.
Identifiers: *Shot noise models, Shot noise processes.

A shot noise process consisting of a series of events at random times and of random magnitudes, each of which produces a fixed shaped rise and recession, was used as the basis for describing continuous time streamflows. This type of model was chosen for its ability to model recessions. Recession shapes consisting of one or two exponential curves were considered. The fitting of the models to multisite daily data and the generation of synthetic daily data were described. The application of the models to some English streamflow data was illustrated. (Sims-ISWS)
W77-05955

OPERATIONAL ASSESSMENT OF HYDROLOGIC MODELS OF LONG-TERM PERSISTENCE,
Washington Univ., Seattle. Dept. of Civil Engineering.
D. P. Lettenmaier, and S. J. Burges.
Water Resources Research, Vol. 13, No. 1, p 113-124, February 1977. 8 fig, 1 tab, 19 ref. NSF DEB74-20744-A02.

Descriptors: *Reservoirs, *Storage requirements, *Model studies, *Mathematical models, Probability, Markov processes, Runoff, Streamflow, Storage, Reservoir storage, Hydrology, Mathematics.
Identifiers: *Autocorrelation.

Two annual flow generation models proposed to account for the Hurst phenomenon, fractional Gaussian noise (FGN), and lag 1 autoregressive-lag 1 moving average (Arma) models, were compared operationally by using the sequent peak algorithm (SPA). The SPA was used to determine empirical probability distributions of storage at a hypothetical single site on the basis of 1000 synthetic annual streamflow traces generated from each model, for constant demands of 0.5, 0.7, and 0.9 of the mean annual flow. The comparisons were made on the basis of population values of the lag 1 correlation coefficient, coefficient of variation, and (for the FGN sequences) Hurst coefficient. For the Arma models, large sample expectations of the Hurst coefficient were used in the comparisons. The fast fractional Gaussian noise (FFGN) generator was used to represent FGN. A modification of the Arma model, the annual Arma-Markov mixture process, was developed and tested. This model has the advantage that the Hurst coefficient is an explicit model parameter. The results of the comparisons showed that at an operating life of 40 years, the unskewed (normal) models gave similar storage probability distributions. The small differences between models could be explained in part by difference in equivalent independent sample sizes of the generated time series. For an operating life of 40 years and H = 0.70, tests of skewed (three-parameter log normal) models gave substantially identical storage probability distributions. For the longer 100-year operating life, storage distributions for the Arma model differed significantly, apparently owing to the lack of an equivalent population H value for this model. (Sims-ISWS)
W77-05957

SYNTHESIS OF SNOWMELT RUNOFF HYDROGRAPHS,
Nevada Univ., Reno. Desert Research Inst.; and Nevada Univ., Reno. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W77-06000

MULTISTATION, MULTIYEAR SYNTHESIS OF HYDROLOGIC TIME SERIES BY DISAGGREGATION,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06008

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN ENVIRONMENTAL DISPERSION MODELS,
Cleveland State Univ., Ohio.
For primary bibliographic entry see Field 2A.
W77-06010

TIME RESOLUTION OF THE HYDROLOGIC TIME-SERIES MODELS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
M. L. Kavvas, L. J. Cote, and J. W. Delleur.
Journal of Hydrology, Vol. 32, No. 3/4, p 347-361, February 1977. 4 fig, 3 ref. OWRT B-036-IND(14).

Descriptors: *Time series analysis, *Data processing, *Statistical methods, *Methodology, *Testing procedures, Stochastic processes, Hydrology, Statistics, Analytical techniques, Mathematical studies, Simulation analysis.
Identifiers: *Spectral analysis, Covariance, Disaggregation methods, Transformations.

The covariance and spectral function relations among the hydrologic time series with time steps which are multiples of each other (e.g., daily, weekly, monthly, and annual intervals) were derived. The relations between the hydrologic sequences corresponding to monthly intervals and the sequences corresponding to annual intervals were verified by the data. Through the utilization of the covariance and spectrum relations for the general aggregation scheme, starting from the smallest interval, the covariance and spectral structures of the hydrologic sequences corresponding to larger sampling intervals can be calculated. The relations show that when the hydrologic time-series models are disaggregated from larger to smaller time sampling intervals, the transformations involved are one-to-many, indicating that there are many ways for the disaggregation whereas there is only one unique way for aggregation. (Singh - ISWS)
W77-06013

2F. Groundwater

A DECOMPOSED AQUIFER MODEL SUITABLE FOR MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.

C. Rodriguez-Amaya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 091, Price codes: A06 in paper copy, A01 in microfiche. Ph.D. Thesis, Spring 1976. 104 p, 32 fig, 18 tab, 47 ref, 4 append. OWRT B-109-COLO(7). 14-31-0001-4067.

Descriptors: Groundwater, *Finite element analysis, Model studies, Aquifers, Conjunctive use, *Aquifer management, *Aquifer systems, *Groundwater movement.
Identifiers: Groundwater management, *Alternating-Direction Implicit method, *Aquifer models.

The main element in the optimum conjunctive and ground waters is the analysis of aquifers in response to the various activities that influence their behavior. This study provides the means to more accurately determine such a response and to facilitate the determination of the optimum management of large aquifers. A model to decompose large aquifer systems has been developed. The mathematical formulation of the model is based on a linear form of the ground water flow equation. The applicability of the model for management studies is presented using a hypothetical aquifer situation. The numerical solution of the flow equation is obtained using the Alternating-Direction Implicity (ADI) method. Unlike traditional approaches to its finite difference approximations, this solution, using the harmonic mean of the transmissivities at the grid points, contains much more physical significance, generates more accurate results and guarantees its convergence. These features are inferred from an ample comparison with existing analytical solutions of simplified cases.
W77-05737

NUMERICAL SIMULATION ANALYSIS OF THE INTERACTION OF LAKES AND GROUND WATER,
Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2H.
W77-05740

ELECTRIC ANALOG SIMULATION OF THE AQUIFERS ALONG THE SOUTH COAST OF PUERTO RICO,
Water Resources Div. Reston, Va. Geological Survey.
G. D. Bennett.
Open-file report, February 1976. 101 p, 36 fig, 11 tab, 32 ref.

Descriptors: *Model studies, *Aquifer characteristics, *Puerto Rico, *Analog models, *Groundwater resources, Available water, Projections, Methodology, Hydrologic budget, Water balance, Withdrawal, Groundwater recharge, *Simulation analysis, Computer models.
Identifiers: *Puerto Rico south coast.

The analog model provides an approximate simulation of the ground-water system of the south coast aquifers of Puerto Rico. The model consists of a three-dimensional reistance-capacitance network and associated inplut and measuring circuitry. The modeled area includes the coastal regions of alluvium and limestone, extending from Guanica on the west to Patillas on the east. The network consists of three lateral or horizontal map-view layers, in which resistors are connected at a node spacing of 800 feet, and capacitors are connected to every other node, at a spacing of 1,600 feet. These horizontal map-view layers are separated by two sets of vertical resistors, also connected at a spacing of 1,600 feet. Lateral hydraulic conductivity values used in constructing the model were calculated from well-performance data. The practical results achieved to data with the model relate to the Yauco-Ponce-Salinas sector. In the Yauco Valley, simulation results indicate that proposed additional pumping of 8 mgd can be developed without saline encroachment. In the Ponce area, simulation results indicate that a dischrge on the order of 2.2 mdg can be withdrawn from the Puerto Rico Aqueduct and Sewer Authority well field, east of Ponce, without appreciable saline encroachment from the new floodway channel. In the Salinas area, results indicate that withdrawals ultimately totalng 3 mdg from a proposed well field to supply the Jobos Bay Power Complex would be sustained largely by retrieval of evapotranspiration, and would not involve permanent saline encroachment. (Woodard-USGS)
W77-05746

MATHEMATICAL MODEL OF THE WEST BOLSA GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Water Resources Div. Atlanta, Ga. Geological Survey.
R. E. Faye.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 659, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 76-71, December 1976. 54 p, 24 fig, 3 tab, 9 ref.

Descriptors: *Hydrogeology, *Groundwater movement, *Mathematical models, *Storage coefficient, *Transmissivity, Aquifer characteristics, Groundwater recharge, Water levels, *California.
Identifiers: San Benito County(Calif), *West Bolsa ground-water basin(Calif).

Simulation of the West Bolsa ground-water basin hydrology in California had provided values of basin recharge and discharge and nodally distributed values of transmissivity and storage coefficient. Average net recharge from April 1945 to March 1969 was 6.2 cubic feet per second and occurred as subsurace recharge and infiltration of rain and minor streamflow. Discharge from the basin during the same period was 8.1 cubic feet per second and occurred as pumping and leakage from confined parts of the basin. Values of transmissivity used in the model generally range from 3,300 to 20,000 feet squared per day. Values of storage coefficient used in the model range from 0.0005 to 0.10. (Woodard-USGS)
W77-05748

LAND-SURFACE SUBSIDENCE AT SEABROOK, TEXAS,
Water Resources Div. Houston, Tex. Geological Survey.
For primary bibliographic entry see Field 4B.
W77-05749

LAND-SURFACE SUBSIDENCE IN THE AREA OF MOSES LAKE NEAR TEXAS CITY, TEXAS,
Geological Survey, Houston, Tex. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05750

PREDICTED EFFECTS OF A PROPOSED WATER-RESOURCE MANAGEMENT PLAN IN THELOWER SAN LUIS REY RIVER VALLEY, CALIFORNIA, USING DIGITAL GROUND-WATER FLOW MODELS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05755

GROUND WATER IN THE HARRISBURG-HALSEY AREA, SOUTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05757

PEAT HYDROLOGY IN THE HULA BASIN, ISRAEL: I. PROPERTIES OF PEAT,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 2G.
W77-05789

PEAT HYDROLOGY IN THE HULA BASIN, ISRAEL: II. SUBSURFACE FLOW REGIME,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 2G.
W77-05790

ON RADIOACTIVE WASTE MANAGEMENT: MODEL ANALYSIS OF A PROPOSED SITE,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 5E.
W77-05791

PERMEATION PROPERTIES OF THE BUNTER SANDSTONE OF NORTHWEST LANCASHIRE, ENGLAND,
Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
P. F. Worthington.
Journal of Hydrology, Vol. 32, No. 3/4, p 295-303, February 1977. 2 fig, 14 ref.

Descriptors: *Aquifers, *Sandstones, *Groundwater movement, Hydraulic conductivity, Permeability, Glacial drift, Clays, Foreign countries, Gravels, Foreign research, Boreholes, Borehole geophysics, Hydrogeology, Geology, Geophysics, On-site investigations.
Identifiers: England, *Lancashire(England), Bunter sandstone, Granular permeability.

Field and laboratory investigatio ns of the Bunter Sandstone aquifer in the Fylde area of northwest Lancashire have indicated that the intergranular component of groundwater flow can vary markedly from place to place and is apparently the predominant mechanism within a sizable area. Elsewhere, intergranular flow is supplemented by fissure drainage and is sometimes relatively insignificant. It was concluded that intergranular permeability exerts a basic control upon abstraction well productivity, with maximum benefits being derived where a comparatively strong intergranular flow is augmented by a well-developed localized fissure network. (Sims-ISWS)
W77-05793

NUMERICAL PUMPING TEST ANALYSIS IN UNCONFINED AQUIFERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and Y.-K. Chan.
Journal of the Irrigation and Drainage Division, American Society of Civil Engineers, Vol. 103, No. IR1, Proceedings Paper 12782, p 1-12, March 1977. 4 fig, 2 tab, 14 ref, 2 append.

Descriptors: *Aquifer testing, *Drawdown, *Numerical analysis, Water table, Computer models, Darcys law, Groundwater movement, Water wells, Test wells, Seepage, *Aquifers, Storage, Percolation.
Identifiers: Finite differences, Delayed yield, Minicomputers.

A numerical model was presented which describes the flow towards an abstraction well in an unconfined aquifer. At each radius, the conditions within the aquifer are described in terms of only two drawdowns, the free surface, and the average drawdown. This model allowed the effects of vertical components of flow, variable saturated depth, water contained within the well, delayed yield, and other factors to be included in a single solution. Results from the numerical model were compared with alternative analytical solutions.

Finally, the technique was used to interpret two pumping tests in unconfined qaufers. (Visocky-ISWS)
W77-05805

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 4B.
W77-05813

HYDROGEOLOGY OF THE FOREMOST AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05817

HYDROGEOLOGY OF THE VERMILION AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05818

HYDROGEOLOGY OF THE EDMONTON AREA (NORTHEAST SEGMENT), ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05819

HYDROGEOLOGY OF THE TRI-CREEK BASIN, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05820

TRICHLOROFLUOROMETHANE IN GROUND WATER - A POSSIBLE INDICATOR OF GROUND-WATER AGE,
Purdue Univ., Lafayette, Ind. Water Resource Research Center.
J. M. Hayes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 170, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. 90, January 1977. 25 p, 4 fig, 2 tab, 26 ref. OWRT A-047-IND(1).

Descriptors: *Groundwater recharge, Groundwater, Tritium, *Indicators, *Aging(Physical), New Jersey, Arkansas, Texas, Gas chromatography, Analytical techniques, Tracers, Air pollution effects, Pollutant identification.
Identifiers: *Groundwater age, *Trichlorofluoromethane, Freon, Wharton tract(NJ), Edwards aquifer(Tex), Hot Springs National Park(Ark).

Trichlorofluoromethane, an entirely man made material, has become a detectable component of the atmosphere. Because of its unique atmospheric history, the presence of CC13F in ground water is potentially significant in terms of ground-water age. The age relationship stems from the fact that precipitation, exposed to CC13F in the atmosphere, will pick up an amount that is proportional to the atmospheric CC13F concentration. If a portion of this water infiltrates into the subsurface to become ground water, it can be differentiated from older ground water (that infiltrated prior to the build-up of CC13F in the atmosphere) on the basis of its CC13F content. In order to evaluate the temporal significance of CC13F in ground water, preliminary investigations were conducted in three areas where the hydrology was well understood and where tritium measurements had been made in the past. They were: the Wharton tract of southern New Jersey, Hot Springs National Park in Hot Springs, Arkansas, and the Edwards aquifer of south central Texas. Good agreement was observed between the CC13F data and the known hydrology. All CC13F measurements were made in the field with a portable gas chromatograph especially designed and built for this purpose.
W77-05851

THE SIMULATION OF WHOLE CORE PERMEAMETER FLOW GEOMETRY,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
L. O. Chemin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 223, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, August 1974, 71 p, 25 fig, 16 ref. OWRT A-023-LA(3) and A-032-LA(3), 14-31-0001-3218 and 3818.

Descriptors: Freshwater, Mathematical models, *Permeability, Porous media, Flow, *Anisotropy, Well testing, Aquifer properties, Saline aquifers, Waste disposal, Artificial recharge, *Simulation analysis, Model studies, Finite element analysis, Flow systems, Wells.
Identifiers: *Flow geometry, *Whole core permeameter, Finite element models, Image well and streamline model.

Numerous studies of fluid flow in porous media have shown that sedimentary formations do not always conduct fluids equally well in all directions in the plane of bedding. This characteristic of preferential directions of flow is referred to as anisotrophic or directional permeability. Various laboratory techniques have been developed to obtain anisotropic permeability data from core samples. One of the more sophisticated techniques employs an apparatus known as a whole core permeameter. At the present time, however, this permeameter is primarily used to analyze isotropic cores whose permeability is not direction sensitive. The necessary analytical description of the flow field within the permeameter has yet to be developed for the case of an anisotropic core. Results are reported of various attempts to simulate this complex flow geometry by means of two different types of mathematical models--a finite element model and an image well and streamline model.
W77-05933

INVESTIGATIONS OF THE WATER BUDGET IN SOIL WITH VEGETATION AND IN BARE SOIL WITH DIFFERENT GROUND WATER LEVELS, (IN GERMAN),
Technische Universitaet, Hanover (West Germany). Institut fuer Meteorologie und Klimatologie.
For primary bibliographic entry see Field 2G.
W77-05939

THERMAL CONVECTION IN A CAVERNOUS AQUIFER,
Florida Univ., Gainesville. Dept. of Civil Engineering.
H. Rubin.
Water Resources Research, Vol. 13, No. 1, p 34-40, February 1977. 4 fig, 11 ref, 1 append.

Descriptors: *Thermal water, *Aquifers, *Groundwater movement, *Model studies, Mathematical models, Convections, Fluid mechanics, Fluid friction, Permeability, Groundwater, Temperature, Water temperature, Heat transfer, Currents(Water), Stability, Equations, Porous media, Hydrology.
Identifiers: *Cavernous aquifers.

Geothermal activity may lead to convection currents in saturated permeable layers within the earth. Instability criteria for such a flow field, in which the fluid flows initially at moderate Reynolds numbers is discussed. Supercritical conditions were analyzed by expanding the finite amplitude perturbations through truncated eigenfunctions. This approach yielded expressions for the intensity of transport processes through the aquifer. It was found that mechanical dispersion due to convection motions reduces the intensity of transport processes. (Sims - ISWS)
W77-05951

DEVIATIONS FROM THE THEIS SOLUTION IN AQUIFERS UNDERGOING THREE-DIMENSIONAL CONSOLIDATION,
Centro di Ricerca IBM di Venezia (Italy).
G. Gambolati.
Water Resources Research, Vol. 13, No. 1, p 62-68, February 1977. 7 fig, 17 ref.

Descriptors: *Consolidation, *Aquifers, *Mathematical models, *Theoretical analysis, *Thesis equation, Finite element analysis, Equations, Drawdown, Permeability, Aquifer testing, Storage coefficient, Depth, Compaction, Deformation, Stress, Potentiometric level, Elastic deformation.
Identifiers: *Dilatation, *Three-dimensional analysis, Half space, Tension center, Strain nucleus, Integrodifferential equations, Parameters.

Previously, a new mathematical model based on the 'tension center' or 'strain nucleus' concept was proposed for the response characterizing flow in a confined aquifer undergoing three-dimensional consolidation. The new approach differs from Biot's approach in that it leads to the development of a unique integrodifferential equation for the pressure head decline occuring within the porous system. The consideration of the horizontal strain components results in a conceptually simple modification of the classical diffusion equation to which a further integrodifferential term accounting for the three-dimensional effect is added. In the present paper, the new equation of flow was solved in a pumped artesian aquifer enclosed in a half space by an iterative finite element technique. It was shown that in shallow and relatively thick units (with W approximately equal to 0.5, where W is the ratio between the average depth and the thickness of the aquifer), downward vertical components of flow develop and that the average drawn deviates moderately from the Theis solution and is no longer uniquely represented against the dimensionless time. The three-dimensional effect produces an additional soil compression which retards the piezometric decline. At large values of time, the horizontal strain components vanish, the diffusion equation holds, and the solution becomes parallel to the Theis provile. As a major consequence, the traditional aquifer tests can still be applied to assess the formation permeability, but they yield a 40% overestimate of the elastic storage coefficient. In deeper units (W greater than 0.5), the importance of the three-dimensional effect diminishes, is already small when W equals 1, and becomes negligible for W greater than or equal to 2. In this case, the diffusion equation and its solutions are sufficiently accurate. From a practical standpoint, the quantitative results given herein are limited by the condition that a mechanically homogeneous and isotropic half space is required. (Visocky - ISWS)
W77-05953

INFLUENCE OF MATRIX CONDUCTION UPON HYDROGEOPHYSICAL RELATIONSHIPS IN ARENACEOUS AQUIFERS,
National Physical Research Lab., Pretoria (South Africa). Geophysics Div.
P. F. Worthington.
Water Resources Research, Vol. 13, No. 1, p 87-92, February 1977. 4 fig, 10 ref.

Descriptors: *Resistivity, *Sand aquifers, *Porosity, Permeability, Geophysics, Sandstones, Electrolytes, Groundwater, *Aquifers, Salinity, Particle size, Clay minerals.
Identifiers: *Matrix conduction, *Effective porosity, *England, Permotriassic sandstone aquifer, Formation factor, Resistivity factor, Intergranular permeability.

The relationship of formation resistivity factor to effective porosity or intergranular permeability in water-saturated sands was shown to be best defined where the solid constituents do not contribute significantly to the conduction of applied current or where corrections for this contribution have been applied to the measured formation resistivities. It was demonstrated that, in the particular case of an argillaceous sand sorted according to its matrix conduction properties, useful relationships between formation resistivity factor and intergranular permeability can be established without any process of correction, provided that porosity and electrolyte salinity do not vary markedly within for formation. This finding was used to resolve the paradox that formation resistivity factor has been reported to increase with intergranular permeability in certain sands and to decrease with increasing values of this same hydrological parameter in others. (Visocky - ISWS)
W77-05954

SALT WATER PUMPING CONTROLS SEA WATER INTRUSION,
Ground Water Consultants Group, Edmonton (Alberta).
For primary bibliographic entry see Field 2L.
W77-05972

WATER QUALITY AS RELATED TO LINEARS, ROCK CHEMISTRY, AND RAIN WATER CHEMISTRY IN A RURAL CARBONATE TERRAIN,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-05998

UNIQUENESS OF A MODEL OF STEADY-STATE GROUNDWATER FLOW,
Nevada Univ., Reno. Desert Research Inst.; and Nevada Univ., Reno. Center for Water Resources Research.
R. L. Cooley, and P. J. Sinclair.
Journal of Hydrology, Vol. 31, No. 3/4, p 245-269, December 1976. 6 fig, 8 tab, 24 ref. OWRT A-054-NEV(2).

Descriptors: *Nevada, *Finite element analysis, *Mathematical analysis, *Hydrogeology, *Groundwater resources, *Aquifer characteristics, Aquifers, Porous media, Steady flow, Transmissivity, Hydraulic conductivity, Groundwater movement.

This study investigated some of the methods and conditions necessary to determine bounds on values of the hydrogeologic parameters which characerize a model of steady-state groundwater flow. The basic tool selected was the optimization approach to determining the parameters. Several methods were investigated for possible use, and modifications of the one by Coats, et al and Yeh and Tauxe were selected for comparison. The results of application of the Coats, et al method to serveral test problems and a field area indicated that occasional large errors may occur even when the input data are very good, and that when the data are subject to various errors, the method is unreliable. Application of a modified version of the Yeh and Tauxe method to test problems and Truckee Meadows, Nevada, yielded much better results than did the method of Coats, et al. There is no unique set of parameters which produce a distinct minimum error for the Truckee Meadows data. The apparent minimum error occurs for transmissivity which is constant throughout the valley. This appears to conflict with the geological and driller's log evidence that shows the existence of zones of differing average hkydraulic conductivity (and presumably transmissivity). The system is not well determined by the 'optimum' parameters, and other combinations of parameters yied solutions that are almost as good. The failure of the water level data to provide a definite optimum solution which conforms to the geological evidence may be due at least in part to the methods normally used to construct water level maps. (Adams-ISWS)
W77-06001

DUPUIT-FORCHHEIMER AND POTENTIAL THEORIES FOR RECHARGE FROM BASINS,
California State Univ., Fullerton. Dept. of Civil Engineering.
R. R. Brock.
Water Resources Research, Vol. 12, No. 5, p 909-911, October 1976. 5 fig, 9 ref. OWRT C-3112(3687)(3).

Descriptors: *Dupuit-Forchheimer theory, *Potential flow, *Groundwater recharge, *Pit recharge, Artificial recharge, Water table, Equations, Groundwater movement, Theoretical analysis, Water level fluctuations, Water table aquifers, Groundwater basins, Percolation, Pores, Mathematical models.
Identifiers: Strip basins, Square basins, Linear models, Non-linear models.

Artificial groundwater recharge from strip and square basins to an unconfined aquifer was investigaed. The classical Dupuit-Forchheimer (DF) theory and the most exact potential theory were used to determine the motion of the water table resulting from recharge. For each theory, both a linear and a nonlinear version were considered. Finite difference schemes were employed to solve the nonlinear models. Analytical solutions exist for the linear models. By comparing the results from the various theories and from experimental results in a sand model, the range of validity of the theories was determined. For sufficiently shallow flows, the DF theories gave results that are good approximations to the potential theories. For sufficiently deep flows, the potential theories must be used, particularly beneath the basin and for small times. The velocity field near a strip basin was determined from the non-linear potential theory for both a deep and a shallow flow. Tabular results were presented that can be used to determine the rise of the water table for strip and square basins. (Visocky-ISWS)
W77-06004

TOWARD AN ANALYTICAL THEORY OF WATER FLOW THROUGH INHOMOGENEOUS POROUS MEDIA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
V. K. Gupta, G. Sposito, and R. N. Bhattacharya.
Water Resources Research, Vol. 13, No. 1, p 208-210, February 1977. 10 ref. OWRT B-046-ARIZ(7).

Descriptors: *Porous media, Flow, *Groundwater movement, Fluid mechanics, *Darcys law, Analytical techniques, Mathematical studies, Equations, Mathematics, Analysis.
Identifiers: *Inhomogeneous porous media, *Buckingham-Darcy law, *Volumetric flux density vector, Vector matric flux potential.

Some rigorous mathematical results for the Buckinham-Darcy flux law for water flow through an isotropic, nondeformable, inhomogeneous porous medium were presented. It was shown that the volumetric flux density vector, aside from the component due to gravity, may always be expressed in terms of a scalar and a vector matric flux potential. The vector matric flux potential will vanish for a homogeneous porous medium and for a one-dimensional inhomogeneous porous medium. It follows from this result that the hydraulic conductivity will be a function only of the water potential in any one-dimensional porous medium if its space derivative at constant water potential vanishes identically. In addition, it was shown that the vector matric flux potential is of no physical consequence insofar as the flow equation is concerned, regardless of the number of dimensions of space. The specification of that part of the flux density vector contributed by the vector potential appears in the law of momentum balance instead of the law of mass balance. (Lee - ISWS)
W77-06014

2G. Water In Soils

EFFECTS OF ANTECEDENT SOIL MOISTURE ON STORM HYDROGRAPHS,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2A.
W77-05603

SOIL SEALING METHOD,
American Colloid Co., Skokie, Ill. (Assignee).
For primary bibliographic entry see Field 3B.
W77-05657

LEACHING OF A HIGHLY SALINE-SODIC SOIL,
Agricultural Univ., Wageningen (Netherlands). Dept. of Soils and Fertilizers.
P. A. Leffelaar, and R. P. Sharma.
Journal of Hydrology, Vol. 32, No. 3/4, p 203-218, February 1977. 12 fig, 5 tab, 22 ref.

Descriptors: *Leaching, *Saline soils, *Alkaline soils, Infiltration, Salts, Sodium, Alkalinity, Salinity, Desalination, Irrigation, Infiltrometers, Soils, Soil chemistry, Soil water movement, On-site investigations, Agriculture, Soil science.
Identifiers: *Desodification.

Leaching curves, both with respect to desalination and desodification of a highly saline-sodic soil, were determined experimentally, using large-sizering infiltrometers. These curves were useful in knowing the amount of water of a given composition needed in order to reduce the harmful levels of salinity and sodicity to the lower desirable values. Different theoretical models were also tested by comparing the calculated and experimental desalinization leaching curves. It was found that there is a reasonably good agreement between theoretical and experimental curves up to nearly 10% of the initial salinity. New empirical relationships on the lines of Reeve's equation were also attempted to fit the experimental data. From the desodification leaching curve, it was concluded that in the reclamation of these soils there is no need of the application of any amendment like gypsum. The infiltration data were also collected to help calculate the amount of water evaporating during reclamation and to predict the time of reclamation. (Sims-ISWS)
W77-05788

PEAT HYDROLOGY IN THE HULA BASIN, ISRAEL: I. PROPERTIES OF PEAT,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
S. Dasberg, and S. P. Neuman.
Journal of Hydrology, Vol. 32, No. 3/4, p 219-239, February 1977. 11 fig, 6 tab, 28 ref.

Descriptors: *Peat, Hydrology, *Hydraulic properties, *Mechanical properties, Laboratory tests, On-site investigations, Bulk density, Porosity, Void ratio, Hydraulic conductivity, Unsaturated flow, Compressibility, Consolidation, Water table, *Organic matter, *Organic soils.
Identifiers: *Israel(Hula Basin), Water retention.

The results of laboratory and field studies concerned with various mechanical and hydraulic properties of peat in the Hula Basin were presented. Particular emphasis was placed on the measurement of bulk density, porosity and void ratio, hydraulic conductivity, water retention under unsaturated conditions, compressibility, release of water due to consolidation, and the content of organic matter. It was shown that the properties of

peat in the basin change drastically when it becomes partially desaturated. As a result of this change, one can distinguish between a permanently saturated layer below the zone of water table fluctuation having relatively uniform characteristics and an overlying, partially desaturated layer, whose properties vary gradually with depth. The saturated layer is currently undergoing a process of consolidation, and therefore, its properties may be expected to change in the future. One of the conclusions reached in this work was that compressibility is very important and must not be neglected in dealing with fluid flow through peats. This is true for confined as well as unconfined (i.e., water table) conditions. (See also W77-05790) (Visocky-ISWS)
W77-05789

PEAT HYDROLOGY IN THE HULA BASIN, ISRAEL: II. SUBSURFACE FLOW REGIME,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soil and Water.
S. P. Neuman, and S. Dasberg.
Journal of Hydrology, Vol. 32, No. 3/4, p 241-256, February 1977. 13 fig, 5 tab, 5 ref.

Descriptors: *Peat, Hydrology, *On-site investigations, *Subsurface flow, Groundwater movement, Soil water movement, Piezometers, Observation wells, Potentiometric level, Water level, Water table, Depth, Stable isotopes, Radioisotopes, Water sampling, Chemical analysis, Topography, Groundwater, Hydraulic gradient, Groundwater recharge, Mixing.
Identifiers: *Israel(Hula Basin).

The subsurface flow regime in the drained portion of the Hula Basin was investigated on a local and regional scale. The results are based on data obtained largely from a three-dimensional network of piezometers and observation wells covering the entire drained area and another three-dimensional network covering a representative experimental plot. The data include measurements of piezometeric levels under various conditions, analyses of stable and radioactive environmental isotopes in water samples from various depths, and chemical analyses of water. It was shown that the position of the water table is controlled by the local topography. The groundwater at depths exceeding 2 m below the surface is subject to a mild regional hydraulic gradient from north to south and a much more pronounced vertical gradient upward. The upwelling groundwater is probably derived from recharge over the surrounding mountains. When the groundwater reaches the water table, it mixes with waters originating at the surface, discharges into the channels and ditches which cross the drained area, and is carried downstream into the Jordan River. One of the important conclusions of this study was that water originating at the surface has practically no change of reaching a depth exceeding 2-3 m. See also W77-05989) (Visocky-ISWSL)
W77-05790

WATER CHEMISTRY OF A STREAM FOLLOWING A STORM, ABSAROKA MOUNTAINS, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W77-05800

SOIL MOISTURE: SOME FUNDAMENTALS,
Lockheed Electronics Co., Inc., Houston, Tex. Aerospace Systems Div.
B. W. Milstead.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-10613, Price codes: A02 in paper copy, A01 in microfiche. Technical Memorandum, (NASA-CR-144525), September 1975. 19 p, 6 fig, 2 tab, 4 ref, 1 append. NASA NAS9-12200.

Descriptors: *Soils, *Soil moisture, *Reviews, Soil classification, Soil types, Soil chemical properties, Soil water, Soil water movement, Moisture content, Measurement, Moisture meters, Particle size, Sands, Clays, Loams, Silts, Soil properties, Soil science, Agriculture.

Soil science has developed to a high degree, and a wealth of information is available concerning the many aspects of soil types, such as their chemical makeup, origin and change, and of course, the significant soil characteristics that relate to agriculture. The handling, moving, and controlling of soil moisture are well understood by the agricultural community, and several methods for measuring the success of these activities are currently in use. The Joint Soil Moisture Experiment has been in progress for several months, and a significant number of measurements have been accomplished for a variety of field conditions. Although the general idea of what the experiment is about is straightforward, a brief tutorial on soil moisture, as it applies to agriculture, is in order. Information in this report was taken from books and papers considered freshman college-level material. It is an attempt to present briefly the basic concept of soil moisture and to acquaint the reader with a minimal understanding of how water interacts with soil. (Sims-ISWS)
W77-05815

SIMPLIFIED TECHNIQUES FOR DETERMINING WATER CONDUCTING AND WATER STORAGE PROPERTIES OF SOILS,
Hawaii Univ., Honolulu. Water Resources Research Center.
L. R. Ahuja, and R. E. Green.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 171, Price codes: A03 in paper copy, A01 in microfiche. Technical Memorandum Report No. 51, October 1976. 33 p, 16 fig, 2 tab, 20 ref. OWRT A-060-HI(1). 14-34-0001-6012.

Descriptors: *Hydraulic conductivity, *Infiltration, *Drainage, *Watershed(Basins), Hydrology, Hawaii, Tensiometers, Soil water, Moisture content, Soil water movement, Water storage, Methodology.
Identifiers: Tantalus silty clay loam, Inceptisols, Richards equation.

Four simplified methods of simultaneously determining both hydraulic conductivity and water characteristic functions of a soil from field tensiometric data for drainage were investigated. These soil-water properties were assumed to be described by certain simple power or logarithmic functional forms. Two of the function parameters were the near-saturated values of soil-water content and hydraulic conductivity, which were assumed to be known (from measurements during infiltration preceding the drainage). The other two unknown parameters were determined either by the least-squares optimization over the complete range of data, or by the algebraic manipulation of data for two consecutive time values. The latter option allowed for a change in values of the parameters in a piecemeal manner. In both cases, the Richards equation of unsaturated soil-water movement was either handled as such in the differential form or was integrated once, before functional substitutions and solutions. A cubic-spline fitting was used for finding derivatives. The schemes of computation were tested and developed on a set of test data with known input parameters, and then applied to a set of field data. The methods involving piecemeal function approximations showed good results.
W77-05853

IRRIGATION SYSTEM OPERATING POLICIES FOR MATURE TEA IN MALAWI,
Institute for Agricultural Research, Zaria (Nigeria).
For primary bibliographic entry see Field 3F.
W77-05920

SURFACE RUNOFF WASHING OF CLAY TAKYRS IN RIDGES WITH HOLES, (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR. Nebit-Dag. Nebit-Dag Agroformelioration Research Station.
I. I. Lalymenko, and S. Berdyev.
Probl Osvoeniya Pustyn' 1, p 89-91, 1975.

Descriptors: *Surface runoff, *Surface waters, *Runoff, *Leaching, *Salts, *Saline soils, Clays.
Identifiers: Planting conditions, Ridges, Takyrs, Turkmen-SSR, USSR, Solonchak.

Studies on solonchak-takyrs in the SW Turkmen SSR (USSR) showed that the entrance of surface runoff water (total volume 9000-30,000 M3/ha) into deep ridges cut 25 M apart resulted in intensive leaching of water-soluble salts. In ridges with planting holes this leaching reached depths of 110-120 cm and in ridges without holes, 80-90 cm. Soils were leached in a strip 200-250 cm wide. The use of this method to create favorable conditions for higher plants is mentioned.--Copyright 1976, Biological Abstracts, Inc.
W77-05938

INVESTIGATIONS OF THE WATER BUDGET IN SOIL WITH VEGETATION AND IN BARE SOIL WITH DIFFERENT GROUND WATER LEVELS, (IN GERMAN),
Technische Universitaet, Hanover (West Germany). Institut fuer Meteorologie und Klimatologie.
R. Kaviani.
Arch Meterol Geophys Bioklimatol Ser B Klimatol Unweltmeteorol Strahlungsforsch 23(4), p 319-329, 1975.

Descriptors: *Hydrologic budget, *Vegetation effects, *Groundwater movement, *Soil water movement, *Soil moisture, *Evapotranspiration, Capillary conductivity, Capillary water, Groundwater availability, Lysimeters, Seepage.
Identifiers: West Germany.

Water seepage, capillary life, soil humidity and evaporation were studied in 2 different vegetation periods in a complex lysimeter investigation. The individual factors vary greatly according to whether the soil is with or without vegetation. They are clearly in accordance with the groundwater level. The evaporation from soil with vegetation exceeds with summer precipitation thus consuming the groundwater reserves. This exhaustion of groundwater is more significant in lysimeters with a low groundwater level than those with a high groundwater level. In both vegetation periods more than 50% of the evaporation was from the constant water level at 50 cm; evaporation at 150 cm was only 1.8-2.9%.--Copyright 1976, Biological Abstracts, Inc.
W77-05939

EFFECT OF SULFURIC ACID ON SODIUM-HAZARD OF IRRIGATION WATER,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
G. S. Gumaa, R. J. Prather, and S. Miyamoto.
Plant and Soil, Vol. 44, p. 715-721, 1976. 1 fig, 5 tab, 13 ref.

Descriptors: *Irrigation water, *Organic acids, Water treatment, *Sodium, Alkaline water, Bicarbonates, Hydraulic conductivity, Irrigation water, Forecasting, *Calcaneous soils.
Identifiers: *Sulfuric acid, *Sodium-hazard, Sodium adsorption ratio(SAR), Exchangeable sodium percentage(ESP).

The conventional method of predicting sodium adsorption ratio (SAR) with adjustment using the pHc index of Langelier overestimates the effect of HCO3-, while an equation based on carbonate equilibria provides a reasonable prediction of SAR in waters containing HCO3- and H2SO4. The SAR, exchangeable sodium percentage (ESP) and

saturated hydraulic conductivity were measured under laboratory conditions in one neutral and four calcareous soils using simulated alkaline irrigation waters with salt concentrations ranging from 7 to 39 meq/l and SAR from 3.8 to 8.4. Sulfuric acid was applied to the waters at rates from 2.1 to 4.7 meq/l to prevent Ca precipitation under an open system. Irrigation waters remained above neutral at these acid rates. SAR, ESP and pH values were reduced in all cases, and hydraulic conductivity of some soils increased when the SAR of original irrigation waters was greater than 7. Application of acid into alkaline irrigation waters at such rates may prevent bicarbonate-induced sodium hazard on water infiltration. If soils are already affected by sodium, acid is generally applied directly on soil surfaces. (Jahns-Arizona)
W77-05942

CHEMICAL ACTIVATION OF GROUNDWATERS OF THE INGUL-VISUN' INTERFLUVE WITHIN THE YAVKINSK IRRIGATION SYSTEM, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science.
V. S. Rodionov, and N. P. Matekina.
Biol Nauki (Mosc) 18(8), p 107-111, 1975.

Descriptors: *Groundwater, *Interfluves, *Irrigation systems, *Mineral water, Hardness(Water), Zone of aeration, Hydrologic budget, Cycles.
Identifiers: Ingul River, Ukrainian-SSR, USSR, Visun River, Yavkinsk.

The planned Yavkinsk irrigation system is located in the southern part of the Ukrainia SSR (USSR) between the Ingul and Visun' rivers. The groundwaters of the Ingul-Visun' interfluve occur sporadically. There is a cyclic pattern in the increase of groundwater minerilization of the aeration zone in the fall which is due to the natural hydrologic regime. These characteristics should be taken into account when developing measures to improve soil conditions on the irrigation system.--Copyright 1976, Biological Abstracts, Inc.
W77-05952

SOILS OF THE TEDZEN-HURGHAB INTERFLUVIAL AREA, (IN RUSSIAN),
Desert Inst., Ashkhabad (USSR).
I. S. Rabochev, K. Redzhepbaev, and P. Esenov.
Probl Osvoeniya Pustyn' 1, p 21-28, 1975.

Descriptors: *Soils, *Hydrosoils(Soils), *Soil formation, *Saline soils, *Groundwater, Nutrients, Fertility, Rotations, Cotton, Alfalfa, Leaching.
Identifiers: Murghab, Tedzhen, Turkmen-SSR, USSR, Tedzen-Hurghab.

Semihydromorphic and hydromorphic soils are common in the area under investigation (Turkmen SSR, USSR). Soil-forming processes are weakly developed. The soils are saline and low in nutrients. The groundwater is highly saline. They reach 1.2-3.0 (5.0) m. in depth. To improve soil fertility cotton-alfalfa crop rotation and leachings are recommended.--Copyright 1976, Biological Abstracts, Inc.
W77-05960

CONVECTIVE-DISPERSIVE SOLUTE TRANSPORT WITH A COMBINED EQUILIBRIUM AND KINETIC ADSORPTION MODEL,
Department of Agriculture, Edmonton (Alberta). Soil Research Inst.
D. R. Cameron, and A. Klute.
Water Resources Research, Vol. 13, No. 1, p 183-188, February 1977. 6 fig, 1 tab, 20 ref. USBR 14-06-D-7052.

Descriptors: *Soil water movement, *Mathematical models, *Adsorption, *Solutes, Equations, Analytical techniques, Theoretical analysis, Model studies, Dispersion, Convection, Porous media, Soils, Seepage, Pesticide kinetics, Transfer, Movement, Nutrients, Pesticides, Soil science.
Identifiers: *Solute transport, *Kinetic adsorption models.

A given chemical may react at different rates with various soil constituents, and the chemical may be involved in several kinds of reactions. A combination of equilibrium and kinetic adsorption models was hypothesized to describe the nature of the overall reaction. An analytical solution to the one-dimensional convective-dispersive transport equation with a combination linear Freundlich isotherm and first-order reversible kinetic adsorption model was developed. The individual and combined effects of the model parameters on the breakthrough curves and retention profiles were examined. The combination equilibrium-kinetic model was shown to be applicable to pesticide, nutrient, and metal transport in soils. (Humphreys-ISWS)
W77-05961

SOIL WATER REGIMES NEAR POROUS CUP WATER SAMPLERS,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
A. W. Warrick, and A. Amoozegar-Fard.
Water Resources Research, Vol. 13, No. 1, p 203-207, February 1977. 4 fig, 1 tab, 14 ref, 1 append.

Descriptors: *Soil water movement, *Unsaturated flow, *Mathematical studies, *Soil science, Equations, Steady flow, Hydraulic conductivity, Analytical techniques, Analysis, Soil water, Sampling, Porous media, Potential flow, Hydraulics, Flow rates, Mathematical models.

Steady soil water regimes near a porous cup water sampler were studied. Results are applicable when one is sampling soil solutions in the field or laboratory, and they help establish guidelines with respect to the sampling volume and region of influence. The unsaturated hydraulic conductivity is taken as $K = (K_o) \exp(\alpha x h)$, where K_o and alpha are constants. The flow net was examined for both point and horizontal line sinks for an infinite medium around the cup. Analytical solutions for the potential and the stream functions were given for the point sink. The maximum radial distance for which flow can be intercepted is the square root of $(q/\pi x K_o) \exp(-\alpha x h_1)$, where h_1 is the pressure head at large distances and q the extraction rate. An alternative form was found by expressing q in terms of the cup radius and tension. For the line sink, an analytical solution was given for the potential, but the stream function required a numerical integration. The maximum distance of influence is $(q/2 K_o) \exp(-a x h_1)$, where q is the flow rate per unit length. For both point and line sinks, q increases with h_1. Also, q at first increases with the suction in the cup ($-h_o$), but it approaches a constant value. (Humphreys-ISWS)
W77-05964

ON SOLVING THE NONLINEAR DIFFUSION EQUATION: A COMPARISON OF PERTURBATION, ITERATIVE, AND OPTIMAL TECHNIQUES FOR AN ARBITRARY DIFFUSIVITY,
Connecticut Agricultural Experiment Station, New Haven.
J.-Y. Parlange, and D. K. Babu.
Water Resources Research, Vol. 13, No. 1, p 213-214, February 1977. 9 ref.

Descriptors: *Soil water movement, *Filtration, *Diffusion, Mathematical models, Equations, Mathematics, Analytical techniques, Soil water, Optimization, *Diffusivity.
Identifiers: *Iterative techniques, *Perturbation.

A recent solution determined by Babu for an arbitrary soil-water diffusivity was compared with two earlier solutions. It was shown that the perturbation solution is identical to the iterative result when Cister's correction is used. It was also shown that a result obtained by optimization, which is numerically indistin guishable from either the perturbation or iterative result, has a much simpler analytical form. (Sims-ISWS)
W77-05969

A WATER MANAGEMENT MODEL FOR HIGH WATER TABLE SOILS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
R. W. Skaggs.
Presented at the 1975 Winter Meeting of the American Society of Agricultural Engineers, December 15-18, 1975. Chicago, Illinois. 27 p, 9 fig, 1 tab, 20 ref. OWRT A-060-NC(6).

Descriptors: *Water management(Applied), *Computer models, *Model studies, Soil water, *Water table.
Identifiers: *High water table soils.

A water management computer model is being developed to simulate the soil water regime for high water table soils. The model is based on a water balance in the soil profile. Approximate methods are used to evaluate infiltration, subsurface drainage, ET, subirrigation, and the soil water distribution within the profile. Inputs to the model are soil properties, parameters of the surface and subsurface drainage systems, and meteorological data. The model provides the capability of predicting the response of the water table and the soil water regime above the water table to rainfall, ET, given degrees of surface and subsurface drainage, and the use of water table control or subirrigation practices. When finally tested and completed the model can be employed to evaluate alternative water management systems and operational procedures by simulating their performance over several years of record. Results of a field experiment to test the validity of the model are presented. Examples of the use of the model for water management system design and evaluation are given. (Skogerboe-Colo St)
W77-05983

RAINFALL INFILTRATION CHARACTERISTICS FOR A SEMI-ARID WATERSHED SOIL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. G. Morse.
Master of Science Thesis, 1976. 77 p, 14 fig, 4 tab, 41 ref. OWRT B-040-ARIZ(2).

Descriptors: *Rainfall, *Rainfall-runoff relationships, *Watershed management, *Rainfall simulators, *Soil water movement, *Infiltration, Semiarid climates, Watersheds(Basins), Soil types, Mathematical models, Hydraulic conductivity, Saturation, Precipitation(Atmospheric), Simulated rainfall, Artificial precipitation, Water resources development, Runoff, Streamflow, Flood control.

Crucial to long term water resource planning, including flood control, is a reliable estimate of runoff and infiltration rates for the watershed under consideration. Rainfall infiltration characteristics of a semi-arid watershed soil near Tucson, Arizona were studied. Laboratory infiltration tests were conducted on reconstructed soil profiles similar to those on the watershed and a mathematical model of infiltration used to simulate the infiltration process. Results from infiltration tests conducted on site at the watershed during a previous research study were also simulated. A realistic rotating disk rainfall simulator was utilized. Objectives of the study were to develop and evaluate techniques for examining in detail factors controlling infiltration of water into a soil. Using the measured saturated hydraulic conductivity values of the laboratory and field soils, and the unsaturated soil properties as measured for the field soil,

the mathematical model of infiltration simulated the infiltration rates of bare soil plots. Direct measurement of surface crusting effects in the laboratory using the dual-source gamma ray attenuation technique was attempted but was determined to be unworkable due to resolution and boundry effect problems. (Jamail-Arizona)
W77-05988

TIME-DEPENDENT LINEARIZED INFILTRATION: III. STRIP AND DISC SOURCES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 3F.
W77-06011

TOWARD AN ANALYTICAL THEORY OF WATER FLOW THROUGH INHOMOGENEOUS POROUS MEDIA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2F.
W77-06014

EXPERIMENTAL AND SIMULATED TRANSPORT OF PHOSPHORUS THROUGH SANDY SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W77-06015

EFFECT OF THE SOIL WATER REGIME ON WATER EXCHANGE OF THE PEACH TREE, (IN RUSSIAN),
L. M. Man'kovskaya.
Izv Akad Nauk Mold SSR SER Biol Khim Nauk 5, p 11-15, 1975.

Descriptors: *Trees, *Soil-water-plant relationships, *Soil moisture, *Moisture content, *Transpiration, Soil water, Water balance, Irrigation water, Productivity, Water utilization, Retention.
Identifiers: *Peach trees, Soil suction, USSR.

The state of water in the leaves, shoots and roots of peach depends on its state in the soil. Changes of the soil water content are accompanied by a redistribution of its individual fractions. After irrigation the water-retaining capacity of the soil and the suction force of the vegetative organs of the plant decrease and the activity of water increases, giving rise to intense transpiration and increased productivity. A more effective use of irrigation water is noted for a soil suction force of 1.5 atm, its water-retaining capacity (atmospheres for extracting 10 g of water) of 4.4 atm and moisture content of 80% of the total moisture capacity.--Copyright 1976, Biological Abstracts, Inc.
W77-06019

NITROGEN TRANSFORMATIONS IN SOIL AS AFFECTED BY THE FUNGICIDES BENOMYL, DYRENE, AND MANEB,
Illinois Univ. at Urbana-Champaign. Dept. of Turfgrass Management.
A. R. Mazur, and T. D. Hughes.
Agronomy Journal, Vol 67, No 6, p 755-758, November-December, 1975. 2 fig, 2 tab, 10 ref.

Descriptors: *Fungicides, *Nitrogen, *Fertilization, *Fertilizers, *Nitrification, *Mineralogy.
Identifiers: *Benomyl, *Dryrene, *Maneb.

The frequency and extent of fungicide use on putting green turfgrasses prompted investigations to determine the effect of three commonly used fungicides on N transformations in soil. Laboratory and field studies were conducted to study the effect of the fungicides benomyl, dyrene and maneb on nitrification and N mineralization in soil. Differences in the effects of these fungicides on nitrification and N mineralization in laboratory as compared to field applications were considered to be the result of lower rates of application associated with more rapid rates of degradation under field conditions as contrasted with the high single rates of application under laboratory conditions. (Skogerboe-Colo St)
W77-06093

FINAL REPORT ON FERTILIZER MOVEMENT THROUGH SOIL RESULTING FROM RAINFALL,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
For primary bibliographic entry see Field 5B.
W77-06096

2H. Lakes

THE EFFECTS OF HEATED WATER DISCHARGE ON ZOOPLANKTON IN A 4,500 ACRE MISSOURI RESERVOIR,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-05604

THE EFFECT OF A THERMAL EFFLUENT ON THE BENTHOS OF THOMAS HILL RESERVOIR, MISSOURI,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-05605

DISTRIBUTION OF FISH SPECIES IN GREAT BEAR LAKE, NORTHWEST TERRITORIES, WITH REFERENCE TO ZOOPLANKTON, BENTHIC INVERTEBRATES, AND ENVIRONMENTAL CONDITIONS,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W77-05612

ISOLATION AND IDENTIFICATION OF POLYCHLORINATED STYRENES IN GREAT LAKES FISH,
National Water Quality Lab., Duluth, Minn.
For primary bibliographic entry see Field 5A.
W77-05621

MERCURY IN THE SURFICIAL SEDIMENTS OF LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W77-05628

VERTICAL DISTRIBUTION OF MERCURY, NICKEL, AND CHROMIUM IN LAKE ERIE SEDIMENTS,
Bowling Green State Univ., Ohio.
For primary bibliographic entry see Field 5B.
W77-05721

THE AGE AND GROWTH OF THE LARGEMOUTH BASS MICROPTERUS SALMOIDES (LACEPEDE), IN A THERMALLY LOADED RESERVOIR,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-05731

GROWTH OF THE WHITE CRAPPIE ON A RESERVOIR RECEIVING A THERMAL DISCHARGE: THOMAS HILL, MISSOURI,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
For primary bibliographic entry see Field 5C.
W77-05732

NUMERICAL SIMULATION ANALYSIS OF THE INTERACTION OF LAKES AND GROUND WATER,
Geological Survey, Lakewood, Colo. Water Resources Div.
T. C. Winter.
Available from the Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA 22202, Price $1.25. Professional Paper 1001, 1976. 45 p, 28 fig, 4 tab, 43 ref.

Descriptors: *Surface-groundwater relationships, *Groundwater movement, *Lakes, *Hydraulic conductivity, Numerical analysis, Hydraulic models, Lake beds, Lake morphology, Lake morphometry, Hydrogeology, Water table, *Simulation analysis.
Identifiers: *Lake-groundwater relationships, Lake water budgets, Groundwater flow systems.

Numerical-model simulations were run to evaluate the factors that control the interaction of lakes and grounder water. The study is concerned only with lakes encircled by water-table mounds that are at a higher altitude than lake level. Simulations of one-lake and multiple-lake systems in vertical sections show that for many hydrogeologic settings, the line (divide) separating local from regional groundwater flow systems is continuous beneath individual lakes. If the divide is continuous, there exists a point along it at which the head is a minimum compared to all other points along the divide. This point of minimum head is always greater than the head represented by lake level, therefore in such a setting there can be no movement of lake water through the lake bed to the ground-water system. In a setting where the divide is not continuous, the lake loses water through part of its bed, but rarely in the littoral zone of the lake. Factors that strongly influence the position, shape and continuity of the flow-system divide beneath lakes are height of the water table on the downslope side of the lake relative to lake level, position and hydraulic conductivity of quifers within the ground-water reservoir, ratio of horizontal to vertical hydraulic conductivity of the ground-water system, and lake depth. (Woodard-USGS)
W77-05740

MAN-MADE TURBIDITY CURRENTS IN LAKE SUPERIOR,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05762

TRANSIENT FINITE ELEMENT SHALLOW LAKE CIRCULATION,
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
F. D. L. Young, and J. A. Liggett.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY2, Proceedings Paper 12741, p 109-121, February 1977. 4 fig, 11 ref, 3 append. NSF GK23992, ENG76-05029.

Descriptors: *Finite element analysis, *Time series analysis, *Water circulation, Lake basins, Lakes, Laplaces equation, Shallow water, Computers, Physical properties, Homogeneity.
Identifiers: *Transient finite element, *Shallow homogeneous lakes, Lake circulation, Laplace transformation, Transients, Shallow lake, Integration, Physical variables, Time stepping method.

A fast method of computing the three-dimensional, time-dependent circulation in shallow homogeneous lakes was presented. The Laplace transform was used to remove the time dependence and to enable vertical integration of the basic equations. The resulting two-dimensional problem was treated numerically by a finite element analysis. The method then employed a numerical transform inversion in order to return to the physical tables. The result was a technique which is more than an order of magnitude faster than is the time stepping method. Numerical results were compared to those obtained by other methods. The development of such a procedure was a major motivation for finding efficient solutions that could be stored in a computer and called at will for graphical presentation. (Roberts-ISWS)
W77-05806

TYPES OF THERMAL PLUMES IN COASTAL WATERS,
Wisconsin Univ., Madison, Marine Studies Center.
For primary bibliographic entry see Field 5B.
W77-05807

THE EFFECT OF POLLUTION ON PHOTOSYNTHETIC ACTIVITY OF ALGAE AND PHYSIOLOGICAL ACTIVITY OF BACTERIA IN LAKE,
Warsaw Univ. (Poland). Dept. of Environmental Microbiology; and Zaklad Microbiologica Woody Sci.
For primary bibliographic entry see Field 5C.
W77-05864

OBSERVATIONS ON SOME MASSIVE FISH KILLS IN LAKE EYRE,
Chief Secretary's Dept., Sydney (Australia). New South Wales Fisheries Branch.
For primary bibliographic entry see Field 5C.
W77-05867

SPECIES DIVERSITY OF LITTORAL ZONE FISHES ALONG A PHOSPHORUS-PRODUCTION GRADIENT IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-05884

CHLORINATED HYDROCARBON RESIDUES IN THE FISH IN LAKE TANGANYIKA,
Antwerpen Univ., Wilrijk (Belgium).
For primary bibliographic entry see Field 5C.
W77-05890

TOXICITY OF PENTACHLOROPHENOL AND 2,3,6- TRICHLOROPHENOL TO THE CRAYFISH (ASTACUS FLUVIATILIS L.),
Helsinki Univ. (Finland). Dept. of Physiological Zoology.
For primary bibliographic entry see Field 5C.
W77-05907

ANNUAL AND SEASONAL FLOW VARIATIONS THROUGH THE STRAITS OF MACKINAC,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
F. H. Quinn.
Water Resources Research, Vol. 13, No. 1, p 137-144, February 1977. 3 fig, 11 tab, 13 ref.

Descriptors: *Great Lakes, *Water balance, *Lake Michigan, *Lake Huron, *Discharge(Water), Flow, Variability, Precipitation(Atmospheric), Analytical techniques, Data collections, Analysis, Evaluation, Evaporation, Water temperature, Lake stages, Surface waters, Straits, Runoff, Annual, Monthly.
Identifiers: *Straits of Mackinac.

The present emphasis on Great Lakes water quality studies requires a knowledge of the average and variability of the net flow between Lakes Michigan and Huron. Average annual and average monthly flows through the Straits of Mackinac were computed for the 1950-1966 period by use of a water budget technique applied to Lakes Michigan and Huron. In addition, water budget computations were compared with a 100-day period of current meter observations taken in 1973. The computations and measurements agreed quite closely, within approximately 2%. A variation of greater than 500% was found between the maximum and minimum annual flows observed during the 17-year computation period. The gross esidence or flushing time for Lake Michigan was determined by two methods. The first determination used the mean annual flow through the straits, resulting in a flushing time of 137 years. The second procedure using the results of the current study, which found a deep return flow into Lake Michigan through the straits during stratification, gave a flushing time of 69 years. In view of the magnitude of this reduction, additional measurements to verify and further quantify the flow regime in the straits during stratification are warranted. (Humphreys-ISWS)
W77-05958

MORPHOMETRIC DEFINITIONS AND CLASSIFICATIONS OF OXBOW LAKES, YUKON RIVER BASIN, ALASKA,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Geology; and Indiana Univ.-Purdue Univ. at Indianapolis. School of Science.
J. G. Weihaupt.
Water Resources Research, Vol. 13, No. 1, p 195-196, February 1977. 4 fig, 1 ref.

Descriptors: *Oxbow lakes, *Lake morphometry, *Classification, *Alaska, Flood plains, Rivers, River beds, Meanders, Evolution.
Identifiers: *Morphometric techniques, *Yukon River Basin(Alas), Ancient rivers, *Oxbow lake symmetry.

Oxbow lakes are seldom studied, except as subsidiary topics in dealing with floodplains or river meanders. Oxbow lakes are important because of the information that they can provide about: (1) the processes affecting river meanders and meander cutoff, (2) the character and environments of the ancient rivers from which they were formed, and (3) the nature and evolution of the oxbow lakes themselves. Definitions, classifications, and morphometric techniques for studying oxbow lakes are suggested. The morphometric techniques are based upon oxbow lake shapes, dimensions, variable components, degree of complexity, degree of oxbow lake limb closure, and oxbow lake symmetry. These characteritics can be used as a basis for quantitative study. (Roberts-ISWS)
W77-05962

WAVE-INDUCED CIRCULATION IN SHALLOW BASINS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-05970

INTERMITTENT 'FULL' UPWELLING IN LAKE ONTARIO,
Woods Hole Oceanographic Institution, Mass.
G. T. Csanady.
Journal of Geophysical Research, Vol. 82, No. 3, p 397-419, January 20, 1977. 23 fig, 2 tab, 9 ref.

Descriptors: *Upwelling, *Lake Ontario, *Winds, Model studies, Mathematical models, On-site investigations, Thermocline, Circulation, Water circulation, Lakes, Temperature, Water temperature, Limnology.
Identifiers: Wind effects.

A strong enough longshore impulse leaving the coast to the left (looking downwind) generates 'full' upwelling in which the thermocline comes to intersect the free surface. This problem is beyond the scope of linearized (small displacement) theory, but it may be treated as a simple geostrophic adjustment problem in which the wind stress is supposed to be exerted impulsively on a two-layer fluid. A minimum impulse was found to be necessary for a full upwelling to develop from hydrostatic equilibrium, the magnitude of which is close to the product of top layer depth and propagation velocity of long waves on the thermocline. When the upwelling-favoring wind impulse is greater than the minimum, the upwelled front moves offshore by a distance proportional directly to the extra impulse (above the minimum) and inversely to top layer depth times Coriolis parameter. Upwelling episodes observed in Lake Ontario during the International Field Year for the Great Lakes (IFYGL), and feasibility studies before IFYGL showed a frontal behavior in good quantitative agreement with the simple theoretical model. The offshore component of the impulsively exerted wind leaves the position of the fron unaffected. However, a sustained offshore wind increases somewhat the offshore displacement due to a prior longshore impulse. The effect is relatively weak, and an offshore wind alone rarely produces full upwelling. A sustained longshore wind acting on an already upwelled thermocline generates considerable negative potential vorticity. Adjustment following such a 'second' longshore impulse produces a more complex thermocline shape and under certain conditions a frontal countercurrent. (Sims - ISWS)
W77-05973

SEASONAL VARIATION IN THE PLANKTON AND PERIPHYTON DIATOMS OF LAKE GEORGE, N.Y.,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
For primary bibliographic entry see Field 5C.
W77-05984

LABORATORY STUDY OF UNSTEADY ENERGY TRANSFER IN SURFACE LAYERS OF STRATIFIED WATER,
Purdue Univ., Lafayette, Ind. School of Mechanical Engineering; and Purdue Univ., Lafayette, Ind. Heat Transfer Lab.
R. Viskanta, and J. R. Parkin.
Water Resources Research, Vol. 12, No. 6, p 1277-1285, December 1976. 10 fig, 1 tab, 15 ref. OWRT A-029-IND(12).

Descriptors: *Energy transfer, *Lakes, *Thermal stratification, Heat transfer, Convection, Laboratory tests, Cooling, Heating, Heat flow, Turbulence, Mixing, Radiation, Solar radiation, Energy, Temperature, Water temperature, Interferometry.
Identifiers: *Stratified water, Surface layers.

A Mach-Zehnder interferometer was used to study the energy transfer in the surface layers of stratified water cooled from above. Laboratory measurements of the unsteady temperature distributions indicated that the thermal structure between the interface and the stable region is controlled by a buoyancy-induced flow, which is established a small distance below the surface. The thermal structure is quite complex, and the column of water can be separated into several regions: (1) the surface skin layer, (2) the thermal boundary layer, (3) the convective layer, (4) the interfacial entrainment lyer, and (5) the stable region. In the skin layer (z less than 0.2 mm), there exists a relatively sharp temperature gradient, and energy is transported by molecular diffusion. Turbulent diffusion contributes to the energy trans-

port in the thermal boundary layer (z between 0.2 and 3 mm), while in the convective layer, heat is transferred primarily by turbulent diffusion and free convection circulation. An unsteady energy transport model was developed by lumping the convective terms with the spatially dependent turbulent diffusivity. A simple expression for the diffusivity based on the kinetic energy equation was derived fro the equilibrium layer. This expression was then used in a polynomial to obtain the vertical diffusivity profile. The theoretical model predicts behavior which is consistent with experimental results and in good agreement with measured vertical temperature profiles. (Sims-ISWS).
W77-06006

SOME STATISTICAL PROPERTIES OF WIND WAVES IN LA CYGNE LAKE,
Kansas Univ., Lawrence. Dept. of Civil Engineering.
Y-S. Yu, and K. S. Ozawa.
Water Resources Research, Vol. 12, No. 6, p 1298-1302, December 1976. 3 fig, 14 ref. OWRT B-032-KAN(2).

Descriptors: *Waves(Water), *Winds, *Lakes, *Kansas, Cooling water, Powerplants, On-site investigations, Data processing, Analytical techniques, Statistical methods, Mathematical models, Measurement, Statistics, Limnology.
Identifiers: *Lake waves, *Lake Cygne Lake(Kan), Wave energy, Wave spectra, Wave gage data.

Wind-generated waves in La Cygne Lake, Kansas, were measured at six different stations in the lake, with wind speeds ranging from 1.2 m/s to 7.8 m/s. Statistical analysis of 50 wave records showed that the measured values of (H sub 1/3)/H sub m and H sub max/H sub m agree well with the predicted values based on the Rayleigh probability law. Normalized wave spectra are similar and follow apparoximately the power law. On the high-frequency side, the 5th power law is a good fit; while on the low-frequency side, the normalized spectral value increases with the 4th power of the normalized frequency. (Sims-ISWS)
W77-06009

HEAT CONTENT OF NORTH MISSISSIPPI RESERVOIRS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W77-06088

PLANKTONIC PROTOZOANS OF THE VOLGA-BALTIC WATER SYSTEM, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
For primary bibliographic entry see Field 5C.
W77-06090

2I. Water In Plants

OBSERVATIONS ON THE MYCOTIC FLORA IN THE PERIPHYTON OF THE TICINO RIVER, (IN ITALIAN),
Pavia Univ. (Italy). Instituto di Botanica.
G. Caretta, A. Cattaneo, and G. del Frate.
Atti Ist Bot Univ Lab Crittogam Pavia 9, p 251-265, 1973.

Descriptors: *Periphyton, *Diatoms, Rivers, Scenedesmus, Aquatic plants, *Aquatic fungi, *Aquatic algae, Cyanophyta.
Identifiers: Achnanthes-minutissima, Candida, Cephalosporium, Cladosporium, Cosmarium, Cymbella, Cymbella-ventricosa, Diatoma-vulgare, Fusarium, Geotrichum, Italy, Melosira-varianus, *Mycotic flora, *Ticino River(Italy), Nitzschia-spp, Phormidium-cebennense, Rhodotorula, Synedra, Trichoderma, Trichothecium.

The algal flora of the Ticino River is characterized by diatoms Nitzschia spp., Diatoma vulgare, Achnanthes minutissima, Cymbella ventricosa, Melosira varianus) and a blue-green (Phormidium cebennese). The algae encountered vary according to the individual pools. The most common genera are Synedra, Scenedesmus, Cosmarium and Cymbella. Fungi isolated from the algae mentioned appear to be numerous and varied. Principal benthic genera are Rhodotorula, Candida, Geotrichum: genera associated with the algae in pools include Trichoderma, Fusarium, Cephalosporium, Cladosporium, Trichothecium and Mucoraceae. It was observed that fungi in the Melosiretum fluviatile association are similar to that of the algae in the pools, but with different generic frequency. It is still to be determined if these differences are due to algae differences or the different ecological conditions of a river and a pool.--Copyright 1976, Biological Abstracts, Inc.
W77-05971

FOREST VEGETATION CONDITIONS OF THE SAND TRACT OF TOSYNKUMY (KAZAKH SSR), (IN RUSSIAN),
A. N. Malan'in, and M. I. Kumanikin.
Probl Osvoeniya Pustyn' 2, p 33-40, 1975.

Descriptors: *Vegetation establishment, *Sand aquifers, *Sands, *Reclamation, *Groundwater, Soil chemical properties, Soil physical properties, Soil-water-plant relationships, Trees, Pine trees, Land use.
Identifiers: Kazakh-SSR, Populus, Silverberry, Tosynkumy, Turango, USSR, *Sandy soils, *Afforestation, Site conditions.

In 1972-1973, the Tosynkumy sand tract (USSR) soil cover and prospects of its reclamation were studied. The physical and chemical properties of major soil cover components are described. According to the depth of ground water, there are 3 groups of sands and sandy soils suitable for afforestation: Site conditions adjacent to water sources are considered favorable for the following trees: silverberry, Turanga (Populus) and pine.--Copyright 1976, Biological Abstracts, Inc.
W77-06031

ON THE POSSIBILITY OF ACCLIMATIZATION OF TILAPIA NILOTICA TO LOW WATER TEMPERATURE CONDITION, (IN JAPANESE),
T. Maruyama.
Bull Freshwater Fish Res Lab (Tokyo) 25(1), p 13-20, 1975.

Descriptors: Tilapia, Aquiculture, *Water temperature, Growth rates, *Spawning, *Winter, Seasonal, Aquatic animals.
Identifiers: *Acclimatization, *Tilapia-nilotica, *Low water temperature.

T. nilotica has many suitable characteristics as an aquaculture species. If they can be adapted to lower water temperatures, they would be more suitable for aquaculture. An experiment was conducted to compare the survival and growth rate between 2 groups of F sub 1 under low temperature conditions. One group was spawned from parents and over-wintered at low temperature; another was spawned from parents and over-wintered at high temperature. In the case of F sub 1 which was reared in high temperature water, ranging from 6.9 to 9.0 cm, 121 died. In the case of F sub 1 reared in cool water, ranging from 8.0 to 11.0 cm, 9 were dead, but they had grown after stocking. The survival rate of the former group was 63.99% and that of latter was 94.64%. The differences between groups are significant. Both groups showed an increase of body length, body weight and condition factors. T. nilotica could endure water temperature lower than 14-16C.--Copyright 1976, Biological Abstracts, Inc.
W77-06033

2J. Erosion and Sedimentation

FATE OF 2,4,5-T CONTAMINANT, 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN AQUATIC ENVIRONMENTS,
Wisconsin Univ., Madison. Dept. of Entomology.
For primary bibliographic entry see Field 5B.
W77-05602

MERCURY IN THE SURFICIAL SEDIMENTS OF LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5B.
W77-05628

CONCENTRATION AND DISTRIBUTION OF SELECTED TRACE METALS IN THE MAUMEE RIVER BASIN, OHIO, INDIANA, AND MICHIGAN,
Ohio State Univ., Columbus. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-05671

VERTICAL DISTRIBUTION OF MERCURY, NICKEL, AND CHROMIUM IN LAKE ERIE SEDIMENTS,
Bowling Green State Univ., Ohio.
For primary bibliographic entry see Field 5B.
W77-05721

THE WATER QUALITY OF STREAMFLOW FROM PONDEROSA PINE FORESTS ON SEDIMENTARY SOILS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 5B.
W77-05734

EROSIONAL LANDFORM MAP OF THE REDWOOD CREEK DRAINAGE BASIN, HUMBOLDT COUNTY, CALIFORNIA, 1947-74,
Geological Survey, Menlo Park, Calif. Wate Resources Div.
For primary bibliographic entry see Field 7C.
W77-05742

USE OF THE RADIOISOTOPIC SAND TRACER (RIST) SYSTEM,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W77-05809

AN APPLICATION OF SYSTEMATIC SAMPLING TO A STUDY OF INFAUNA VARIATION IN A SOFT SUBSTRATE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5A.
W77-05863

MOVEMENT OF MIREX FROM SEDIMENT AND UPTAKE BY THE HOGCHOKER, TRINECTS MACULATUS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W77-05876

THE EFFECTS OF COARSE GRANITIC SEDIMENT ON THE DISTRIBUTION AND ABUNDANCE OF SALMONIDS IN THE CENTRAL IDAHO BATHOLITH,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 4C.
W77-05932

SURFACE RUNOFF WASHING OF CLAY TAKYRS IN RIDGES WITH HOLES, (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR. Nebit-Dag. Nebit-Dag Agroformelioration Research Station.
For primary bibliographic entry see Field 2G.
W77-05938

FLOOD EFFECTS ON STREAM ECOSYSTEMS,
Soil Conservation Service, Little Rock, Ark.
For primary bibliographic entry see Field 4D.
W77-05949

MORPHOMETRIC DEFINITIONS AND CLASSIFICATIONS OF OXBOW LAKES, YUKON RIVER BASIN, ALASKA,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Geology; and Indiana Univ.-Purdue Univ. at Indianapolis. School of Science.
For primary bibliographic entry see Field 2H.
W77-05962

EROSION MEASURED FROM A LISTER-TILL SYSTEM,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 4D.
W77-06089

2K. Chemical Processes

LIQUID SAMPLING,
Pro-Tech, Inc., Malvern, Pa. (Assignee).
For primary bibliographic entry see Field 5A.
W77-05658

AN ASSESSMENT OF VARIOUS TYPES OF REFERENCE ELECTRODE FOR USE IN CONTINUOUS POTENTIOMETRIC ANALYSIS WITH PARTICULAR APPLICATION TO HIGHLY PURE WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
D. Midgley, and K. Torrance.
The Analyst, Vol. 101, No. 1208, p 833-847, November, 1976. 4 fig, 9 ref, 11 tab.

Descriptors: *Electrodes, *Potentiometers, *Water analysis, Instrumentation, Equipment, Ultraviolet radiation, Flow rates, Temperature, Performance.

The suitability of different reference electrodes for continuous potentiometry of highly pure water has been assessed. The electrodes were chosen to be as representative as possible of their class, but several electrodes of novel design were also included. The electrodes were tested for the constancy of their potentials over 100 days of continuous operation in 0.00001 mole/liter NaOH solution (a model boiler water) and for the extent to which they were affected by ultraviolet light, particulate matter, and changes in flow rate and ionic strength. The times taken by the electrodes to recover from changes in temperature, from an interruption in the flow of sample, and from being immersed in buffer solutions were measured and proved to be important characteristics in discriminating between the overall performance of electrodes. It is concluded that conventional types of electrodes, whether calomel or silver/silver chloride, with ceramic frit junctions and unsaturated potassium chloride electrolytes, are superior in almost every respect to the other types tested. (Witt-IPC)
W77-05678

DETERMINATION OF URANIUM IN NATURAL WATER BY PRECONCENTRATION ON ANION-EXCHANGE RESIN AND DELAYED-NEUTRON COUNTING,
Atomic Energy Board, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W77-05682

WATER TEMPERATURES OF KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05743

WATER-QUALITY INVESTIGATION, SALINAS RIVER, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05751

COMPOSITION OF SELECTED RAIN SAMPLES COLLECTED AT MENLO PARK, CALIFORNIA IN 1971,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05754

CHEMICAL QUALITY OF GROUND WATER IN THE TEHAMA-COLUSA CANAL SERVICE AREA, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-05756

GROUND WATER IN THE HARRISBURG-HALSEY AREA, SOUTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05757

INDEX OF SURFACE-WATER STATIONS IN TEXAS, OCTOBER 1976,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W77-05760

WATER CHEMISTRY OF A STREAM FOLLOWING A STORM, ABSAROKA MOUNTAINS, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology.
W. R. Miller, and J. I. Drever.
Geological Society of America Bulletin, Vol. 88, No. 2, p 286-290, February 1977. 5 fig, 3 tab, 15 ref. NSF GA-40673, GSA-1690-73.

Descriptors: *Water chemistry, *Wyoming, *Water quality, *Storm runoff, *Water analysis, *Storm water, Chemistry, Analytical techniques, Water properties, Streams, Surface runoff, Storms, Rain, Leaching, Floods, Variability, Chemical analysis.
Identifiers: *Absaroka Mountains, *Shoshone River, Mountain streams, Factor analysis.

Variation in the chemistry of the North Fork of the Shoshone River following a storm cannot be explained simply by dilution of the base flow by rainwater. Factor analysis of the variation indicated that during the early part of the flood cycle, the most important control is solution of readily soluble salts from the soil zone. During the later part of the flood, the dominant control is dilution of the base flow. Other significant controls during both parts of the flood cycle are selective weathering of ferromagnesian minerals and leaching of potassium from biological material. Variation in water chemistry during a storm can be used to reveal information about weathering processes occurring at different depths in the soil and weathered rock zones. (Henley-ISWS)
W77-05800

A BIBLIOGRAPHY OF SOVIET LITERATURE ON FRESHWATER HYDROBIOLOGY AND RELATED PROBLEMS FOR 1975: PART 20, (IN RUSSIAN),
For primary bibliographic entry see Field 5B.
W77-05854

EFFECT OF SULFURIC ACID ON SODIUM-HAZARD OF IRRIGATION WATER,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W77-05942

AN EVALUATION OF SOME FLUORESCENT DYES FOR WATER TRACING,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W77-05950

CHEMICAL ACTIVATION OF GROUNDWATERS OF THE INGUL-VISUN' INTERFLUVE WITHIN THE YAVKINSK IRRIGATION SYSTEM, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-05952

WATER QUALITY AS RELATED TO LINEARS, ROCK CHEMISTRY, AND RAIN WATER CHEMISTRY IN A RURAL CARBONATE TERRAIN,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W77-05998

NITROGEN TRANSFORMATIONS IN SOIL AS AFFECTED BY THE FUNGICIDES BENOMYL, DYRENE, AND MANEB,
Illinois Univ. at Urbana-Champaign. Dept. of Turfgrass Management.
For primary bibliographic entry see Field 2G.
W77-06093

2L. Estuaries

SEAWATER ADAPTATION IN ATLANTIC SALMON (SALMO SALAR L.) AT DIFFERENT EXPERIMENTAL TEMPERATURES AND PHOTOPERIODS,
Institute of Marine Research, Bergen (Norway).
For primary bibliographic entry see Field 5C.
W77-05626

EFFECTS OF ENVIRONMENTAL DISTURBANCE ON THE DISTRIBUTION AND PRIMARY PRODUCTION OF BENTHIC ALGAE ON A BRITISH COLUMBIA ESTUARY,
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
For primary bibliographic entry see Field 5C.
W77-05635

BENTHIC FAUNAL DYNAMICS DURING SUCCESSION FOLLOWING POLLUTION ABATEMENT IN A SWEDISH ESTUARY,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5C.
W77-05647

DDT RESIDUES IN BENTHIC INVERTEBRATES AND DEMERSAL FISH IN ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5C.
W77-05649

EFFECTS OF KRAFT PULPING EFFLUENTS ON THE BENTHIC ALGAL POPULATIONS IN NORTHWESTERN SPAIN. I. DISTRIBUTION AND ABUNDANCE OF CHARACTERISTIC FUCACEAE (INCIDENCIA DE VERTIDOS INDUSTRIALES EN LA ESTRUCTURA DE POBLACIONES INTERMAREALES. I. DISTRIBUCION Y ABUNDANCIA DE FUCACEAS CARACTERISTICAS),
Instituto de Investigaciones Pesqueras, Vigo (Spain).
For primary bibliographic entry see Field 5C.
W77-05690

A STRUCTURAL-FUNCTIONAL ANALYSIS OF THE SOCIO-POLITICAL SYSTEM RELATIVE TO WATER AND RELATED LAND RESOURCES IN THE COASTAL ZONE OF SOUTH CAROLINA,
Clemson Univ., S. C. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W77-05722

GAS SATURATION AND MODIFYING HYDROLOGICAL FACTORS IN ESTUARINE WATER USED FOR COOLING A STREAM ELECTRIC PLANT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5C.
W77-05780

COMPUTATIONAL HYDRAULICS: A SHORT PATHOLOGY,
Danish Hydraulic Inst., Copenhagen. Computational Hydraulics Center.
For primary bibliographic entry see Field 8B.
W77-05797

ON THE EFFECT OF BAROTROPIC CURRENT FLUCTUATIONS ON THE TWO-LAYER TRANSPORT CAPACITY OF A CONSTRICTION,
Norges Tekniske Hoegskole, Trondheim. River and Harbor Lab.
A. Stigebrandt.
Journal of Physical Oceanography, Vol. 7, No. 1, p 118-122, January 1977. 6 fig, 1 tab, 6 ref.

Descriptors: *Fjords, *Currents(Water), *Fluctuations, *Water transfer, Salinity, Density, Saline water-freshwater interfaces, Flow, Foreign research, Mixing, Sea water, Estuaries, Coasts, Model studies, Mathematical models, Laboratory tests.
Identifiers: *Barotropic currents, *Oslofjord(Norway), *Norway.

A simple theory shows that the two-layer transport capacity of a constriction may be increased considerably by barotropic current fluctuations. this was confirmed by laboratory experiments. The effect may be of great importance for the deep water renewal process in some sill fjords and for the hydrographic conditions in some overmixed estuaries. (Sims-ISWS)
W77-05801

REDERIVATION OF THE SATURATION RANGE IN THE FREQUENCY SPECTRUM OF WIND-GENERATED GRAVITY WAVES,
Naval Postgraduate School, Monterey, Calif. Dept. of Oceanography.
E. B. Thornton.
Journal of Physical Oceanography, Vol. 7, No. 1, p 137-140, January 1977. 2 fig, 9 ref. ONR NR-083-275, NR-388-114.

Descriptors: *Waves(Water), *Winds, *Gravity waves, *Model studies, Mathematical models, Laboratory tests, Frequency analysis, Energy, Velocity, Ocean waves, Shallow water, Deep water, Oceanography.
Identifiers: *Wave spectra, Wind-generated waves.

The saturation range in the frequency spectrum of wind-generated waves was rederived. Laboratory and theoretical work showed that wave breaking is the result of kinematic instability, suggesting that wave celerity is the governing parameter in the saturation range. Using similarity arguments, a general formulation was rederived, giving the wave profile spectrum S sub eta (omega) is proportional to omega to the (-5) power in deep water as derived by Phillips and S sub eta (omega) is proportional to omega to the (-3) power in shallow water. The velocity spectrum in the saturation range was derived, using linear wave theory as a spectral transfer function. In both deep and shallow water, the horizontal velocity spectrum is S sub u (omega) is proportional to omega to the (-3) power. Wave and velocity measurements made in deep and shallow water are presented, showing agreement with theory. (Sims-ISWS)
W77-05802

NUMERICAL MODEL OF STRATIFIED ESTUARY FLOWS,
International Course in Hydraulic Engineering, Delft (Netherlands).
D. O. Hodgins, T. R. Osborn, and M. C. Quick.
Journal of the Waterway, Port, Coastal and Ocean Division, American Society of Civil Engineers, Vol. 103, No. WW1, Proceedings Paper 12734, p 25-42, February 1977. 8 fig, 14 ref, 2 append.

Descriptors: *Density currents, *Mathematical models, *Canada, *Estuaries, Numerical analysis, Saline water, Saline water intrusion, *Stratified flow, Tidal waters, Salts, Rivers.
Identifiers: *Density flow, *Fraser River estuary, Tidal currents, Two phase flow.

Salt water intrusion in the Fraser River estuary was modeled numerically and compared with a field measurement program. The salt wedge was observed to have a highly dynamic behavior and yet to retain its stratified character. The main physical and computational problems studied were: (1) the interfacial stress term; (2) the necessary boundary conditions at the river mouth; and (3) the computational stability. The approach described for modeling stratified flows gives a satisfactory description of the large-scale hydraulic features in the Fraser estuary, British Columbia, Canada. In general, it provides the type of numerical model that can be used for engineering studies in other moderately or highly stratified estuaries. (Roberts-ISWS)
W77-05804

OBSERVATIONS OF THE MOTION FIELD OF THE CONNECTICUT RIVER PLUME,
Connecticut Univ., Groton. Marine Science Inst.; and Connecticut Univ., Groton. Dept. of Geology and Geophysics.
R. W. Garvine.
Journal of Geophysical Research, Vol. 82, No. 3, p 441-454, January 20, 1977. 18 fig, 1 tab, 14 ref, 1 append.

Descriptors: *Rivers, *Estuaries, *Water circulation, *Connecticut River, Tide waters, Tides, Buoys, Flow, Coasts, Dye releases, Aerial photography, Aircraft, Tracking techniques, Tracers, Freshwater-saline water interfaces, Salinity, Mapping.
Identifiers: *Drogues, *Long Island Sound, *Drifters, Fronts(Water), *Plumes(Rivers).

Observations of the motion field associated with the plume formed by the outflow of the Connecticut River into the coastal seawater of Long Island Sound were presented. Approximately 35 drogues and drifters were tracked for each of three experiments using an airborne camera. The trajectories and the Eulerian velocity field deduced from them was presented. The offshore boundary of the plume as formed by a front where there was a strong discontinuity at the surface in both the velocity and density fields. In addition to a vigorous outflow of plume surface water away from the river mouth and parallel to the plume axis, the observations showed a pronounced surface flow toward the front and normal to the axis, which was consistent with frontal convergence. The speed of plume water was found to be highly supercritical. The motion of nearby ambient seawater appeared to be little affected by the plume. (Sims-ISWS)
W77-05808

USE OF THE RADIOISOTOPIC SAND TRACER (RIST) SYSTEM,
Coastal Engineering Research Center, Fort Belvoir, Va.
C. W. Judge.
Available from the National Technical Information Service, Springfield VA 22161 as AD-A014 168, Price codes: A05 in paper copy, A01 in microfiche. Technical Memorandum No. 53, June 1975. 75 p, 21 fig, 26 ref, 3 append. NRC AT(49-11)-2988.

Descriptors: *Beaches, *Littoral drift, *Isotope studies, *Tracers, *Radioisotopes, Gold radioisotopes, Sands, Sediments, Movement, On-site investigations, Coasts, Coastal engineering, Data processing, Automation, Geomorphology, *Sediment transport.
Identifiers: *Sand tracing, Littoral processes.

The Coastal Engineering Research Center (CERC), under a multiagency program initiated in 1966, has developed a synoptic sand tracing system capable of operating on the beach, in the surf zone, and offshore. This system has application in determining sediment movement along coastal areas. Some specific problems to which the system can be applied are: (1) mechanisms of sediment movement; (2) improving beach fill criteria; (3) relation of engineering structures to sediment transport; and (4) movement of disposal materials. (Sims-ISWS)
W77-05809

LARVAL MORTALITY IN MARINE FISHES AND THE CRITICAL PERIOD CONCEPT,
Hawaii Inst. of Marine Biology, Honolulu.
R. C. May.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 3-19, 2 tab, 98 ref.

Descriptors: Population, *Larval growth stage, *Mortality, Aquatic populations, Food abundance, *Fish populations, Environmental effects, *Marine fish.
Identifiers: Year-class strength.

The critical period concept is defined as the proposal that most larval mortality is concentrated during a relatively short period of early development. The paper reviews several variants of this definition and examines evidence for the critical period in marine fishes. The concept maintains that the strength of a year-class is determined by the availability of planktonic food shortly after the larval yolk supply has been exhausted. Survival curves for larval fishes collected in the sea did not justify firm rejection or acceptance of this concept. Although field and laboratory data suggested that starvation may be an important cause of larval mortality at the end of the yolk-sac stage, the rela-

tion between starvation-induced mortality at yolk-absorption and year-class strength remained unclear. It was concluded that different species react differently to food deprivation, and the feeding condition facing a given species will vary both spatially and temporally. (See also W77-05821) (Chilton-ORNL)
W77-05822

LARVAL MORTALITY AND SUBSEQUENT YEAR-CLASS STRENGTH IN THE PLAICE (PLEURONECTES PLATESSA L.),
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
R. C. A. Bannister, D. Harding, and S. J. Lockwood.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 21-37, 7 fig, 4 tab, 30 ref.

Descriptors: Population, *Environmental effects, *Larval growth stage, *Mortality, Temperature, *Fish populations, Foodabundance, Predation.
Identifiers: Year-class strength, *Plaice.c

The data demonstrated a high early mortality for the period between egg production and the end of the 1-group stage which was regarded as being characteristic of fecund populations. The data were also in line with the concept that year-class strength may be largely determined in the planktonic phase. It was suggested that reduced temperature will prolong development and increase the time of potential exposure to predation, and that low temperatures could result in predators being low in number, abnormally distributed or not feeding as heavily as at average temperatures. This could reduce both egg and larval mortality rates. (See also W77-05821) (Chilton-ORNL)
W77-05823

THE DISTRIBUTION AND MORTALITY OF SOLE EGGS (SOLEA SOLEA L.) IN INSHORE AREAS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
J. D. Riley.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 39-52, 3 tab, 6 fig, 4 ref.

Descriptors: Population, *Growth stages, *Fish eggs, Larval growth stage, *Mortality, *Distribution, Coasts, Spawning, *Fish populations, *Mortality.
Identifiers: *Solea solea(Eggs).

Distribution of sole eggs and larvae off the English east coast was surveyed by samples from the whole coastal spawning area in 1970 and over an almost complete spawning season in the River Blackwater area in 1969. Eggs were sorted into developmental stages and the production of the stages was compared. Proportions of egg stages were found not to be significantly different between regions. Abundance of each stage was dependent upon the numbers of eggs present and the duration of each stage. Estimates of the numbers of eggs produced per day were plotted against the midpoints of the five developmental stages and the slopes of the fitted regression lines indicated an egg mortality of 95.65% during 1969 in the River Blackwater and 99.95% on the English east coast in 1970. (See also W77-05821) (Chilton-ORNL)
W77-05824

SEASONAL CHANGES IN DIMENSIONS AND VIABILITY OF THE DEVELOPING EGGS OF THE CORNISH PILCHARD (SARDINA PILCHARDUS WALBAUM) OFF PLYMOUTH,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
A. J. Southward, and N. Demir.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 53-68, 2 tab, 9 fig, 39 ref.

Descriptors: Population, *Environmental effects, *Embryonic growth stage, Growth stages, *Fish populations, Eggs, Mortality, *Seasonal.
Identifiers: *Cornish pilchard(Eggs), Sardina pilchardus.

Thirty stations were sampled monthly from August 1969 to November 1970. The eggs were staged and their mortality and dimensions assessed. Overall mortality averaged 50% (38% in August to 92% in November) with most of the dead eggs belonging to stages 2, 3, and 4. Reduction of mortality after stage 5 appeared to be connected with the closure of the blastopore. High mortality in winter appeared to be related to temperature. Considerable seasonal change was found in capsule diameter and in diameter of the yolk mass and oil globule, apparently inversely related to sea temperature. Smallest eggs occurred in summer and largest in winter. (See also W77-05821) (Chilton-ORNL)
W77-05825

ENVIRONMENTAL INFLUENCES ON THE SURVIVAL OF NORTH SEA COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 5C.
W77-05826

SOME FACTORS INFLUENCING EARLY SURVIVAL AND ABUNDANCE OF CLUPEONELLA IN THE SEA OF AZOV,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
For primary bibliographic entry see Field 5C.
W77-05827

SOME OBSERVATIONS ON THE POPULATION DYNAMICS OF THE LARVAL STAGE IN THE COMMON GADOIDS,
Marine Lab., Aberdeen (Scotland).
R. Jones, and W. B. Hall.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 87-102, 1 tab, 2 fig, 25 ref.

Descriptors: *Environmental effects, Population, *Food abundance, *Fish populations, Growth stages, *Larval growth stage.
Identifiers: *Cod, *Haddock, Feeding strategies.

Food density has been shown to be critical for survival during the larval stage of fish. Haddock and cod larvae appeared to feed on the young growing stages of their food species. By eating only the largest organisms which it is capable of ingesting, a larva could minimize the number organisms needed per day but at the expense of reducing the availability of suitable food. Larva could increase the density of suitable food by eating smaller organisms but at the expense of increasing the number required per day. In practice, feeding strategy appeared to be a compromise between these alternatives. Simulation of the effects of competition between genotypes with different feeding strategies suggested that a species like the haddock should be able to maximize its chances of survival by eating juvenile copepods born with a 5-20 day period. (See also W77-05821) (Chilton-ORNL)
W77-05828

THE POSSIBLE DENSITY-DEPENDENCE OF LARVAL MORTALITY AND ADULT MORTALITY IN FISHES,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
D. H. Cushing.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 103-111, 7 fig, 1 tab, 10 ref.

Descriptors: *Environmental effects, Population, Predation, *Fish populations, Food abundance, Fish, *Mortality, Larval growth stage, Mature growth stage.
Identifiers: *Herring, *Cod, Density-dependence, Population density.

The natural mortality of plaice is formulated as a density-dependent function of age. The rationale for the concept is that predation is density-dependent because of the time to search and that fish grow with age through a series of increasingly larger predatory fields. An attempt is made to fit this theory to data on the Boothbay Harbor herring and the Baltic cod. Analysis of the cod data showed that the control mechanisms predominated during the larval drift in most years, but in one year class some control occurred on the nursery ground. The data fit a curve of density-dependent mortality with age quite well. (See also W77-05821) (Chilton-ORNL)
W77-05829

LARVAL ABUNDANCE IN RELATION TO STOCK SIZE, SPAWNING POTENTIAL AND RECRUITMENT IN NORTH SEA HERRING,
Rijksinstituut voor Visserijonderzoek, Ymuiden (Netherlands).
K. H. Postuma, and J. J. Zijlstra.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 113-128, 6 tab, 7 fig, 17 ref.

Descriptors: *Environmental effects, Population, *Fish populations, *Larvae, *Spawning, *Herrings, Temperature.
Identifiers: *North Sea.

A reappraisal was made of the material on larvae and stock size for two areas of the North Sea, the Downs and the Dogger. It was concluded that larval abundance offers a reasonable measure for spawning stock size. Larval abundance appeared to be also dependent on temperature conditions in the spawning area. The relation was positive in the Downs area and negative in the Dogger herring. Data connecting spawning stock-size with subsequent recruitment was present but not in complete conformity. (See also W77-05821) (Chilton-ORNL)
W77-05830

RELATIONS BETWEEN EGG PRODUCTION, LARVAL PRODUCTION AND SPAWNING STOCK SIZE IN CLYDE HERRING,
Marine Lab., Aberdeen (Scotland).
A. Saville, I. G. Baxter, and D. W. McKay.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 129-138, 4 fig, 1 tab, 14 ref.

Descriptors: Population, *Reproduction, *Eggs, *Larvae, *Spawning, *Herrings, *Mortality, *Fish populations.
Identifiers: Density-dependent mortality, Year-class strength, *Clyde herring.

Surveys of the abundance of eggs and early larval stages of Clyde spring spawning herring have been carried out over the spawning area since 1958.

Quantitative estimates of annual egg deposition and of the annual production of early larval stages are made and related to the corresponding estimates of the spawning potential of the stock. The relationship between annual larval production and spawning potential of the stock suggests that in herring there is a density-dependent mortality in the egg stage at high levels of spawning potential. The fact that in these data there is no statistically significant relationship between larval production and year-class strength suggest that there is a subsequent stage where density-dependent mortality again operates. (See also W77 05821) (Chilton-ORNL)
W77-05831

THE USE OF DATA ON EGGS AND LARVAE FOR ESTIMATING SPAWNING STOCK OF FISH POPULATIONS WITH DEMERSAL EGGS,
Institute of Marine Research, Bergen (Norway).
J. Gjosaeter, and R. Saetre.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 139-149, 1 tab, 4 fig, 29 ref.

Descriptors: Population, *Estimating, Estimating equations, *Larvae, *Spawning, *Fish populations, Hatching, *Demersal fish, *Eggs.

Two methods for estimating the size of the spawning stock for fish with demersal eggs are described. Both methods assume that the hatching curve is known, and only newly hatched larvae are used. In one method the number of eggs deposited at one of the spawning beds is determined. After hatching begins an abundance index for young larvae released from this spawning bed is obtained, and referred to a known point on the hatching curve. The ratio between number of eggs and this index, together with the hatching curves and larval abundance index for the whole spawning area are used to estimate the spawning stock size. In the other method, the hatching curve is used for calculating the percentage of eggs that are hatched at any time. On the assumption that the number of newly hatched larvae sampled corresponds to this percentage, the size of the spawning stock may be found. (See also W77-05821) (Chilton-ORNL)
W77-05832

SIGNIFICANCE OF EGG AND LARVAL SURVEYS IN THE STUDIES OF POPULATION DYNAMICS OF FISH,
Tokyo Univ. (Japan). Ocean Research Inst.
S. Tanaka.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 151-157, 2 tab, 3 fig, 11 ref.

Descriptors: Population, *Fish populations, *Surveys, *Eggs, *Larvae, Estimating, Spawning.
Identifiers: *Japanese sardine, Japan.

A spawning survey for the Japanese sardine, Sardinoos melanosticta, was conducted to provide information on the size of the population and its rate of exploitation. The abundance of the spawning population of sardine was estimated by dividing the total abundance of eggs spawned by the fecundity of the female and the ratio of females among the total. The effort and cost required for egg and larval surveys is stated to be considerable. The cost per sample is estimated at 2200 yen. (See also W77-05821) (Chilton-ORNL)
W77-05833

SEASONAL FLUCTUATIONS IN THE ABUNDANCE OF THE LARVAE OF MACKEREL AND HERRING IN THE NORTHEASTERN ATLANTIC AND NORTH SEA,
Institute for Marine Environmental Research, Plymouth (England).
V. Bainbridge, G. A. Cooper, and P. J. B. Hart.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 159-169, 4 fig, 25 ref.

Descriptors: Population, *Seasonal, *Fluctuations, Larvae, *Herrings, Spawning, Foods, Atlantic Ocean.
Identifiers: *Mackerel, North Sea.

A Continuous Plankton Recorder Survey provided information for the study. Two main populations of mackerel larvae were found, one centered in the Celtic Sea during spring, and the other in the Central North Sea during the summer. Larvae produced by most of the main stocks of winter-spring and summer-autumn spawning groups of herring could be delimited from their seasonal and geographical distributions. Larval production by stocks of mackerel and herring spawning in deep water near the continental margin were closely associated with the biological spring when food for the larvae was most plentiful. Mackerel in the North Sea spawn during the summer, a possible adaptation to temperature conditions at the northern limit of its range. It was suggested that herring stocks spawning in the later autumn or winter would likely encounter poor feeding conditions until the following spring. (See also W77-05821) (Chilton-ORNL)
W77-05834

THE DISTRIBUTION AND LONG TERM CHANGES IN ABUNDANCE OF LARVAL AMMODYTES MARINUS (RAITT) IN THE NORTH SEA,
Institute for Marine Environmental Research, Edinburgh (Scotland). Oceanographic Lab.
P. J. B. Hart.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 171-182, 8 fig, 2 tab, 25 ref.

Descriptors: Population, *Environmental effects, *Larvae, *Distribution, *Phytoplankton, Seasonal.
Identifiers: *Ammodytes marinus.

A Continuous Plankton Recorder Survey provided information for the study. Particular attention was paid to possible sources of error in the data, arising from the sampling method. Three centers of sand-eel larvae concentrations were established. The time of first appearance at the beginning of the year, within each centre, was found to be correlated with the timing of the spring phytoplankton bloom. It was pointed out that this may indicate a direct link between larvae and phytoplankton. The hypothesis was proposed that high abundance of the larvae is directly related to greater penetration of Atlantic water into the North Sea, an influence strongly modified by the fishery for adults, which resulted in a decrease in numbers of larvae. (See also W77-05821) (Chilton-ORNL)
W77-05835

EFFICIENCY TEST ON FOUR HIGH-SPEED PLANKTON SAMPLERS,
Institute of Marine Research, Bergen (Norway).
For primary bibliographic entry see Field 7B.
W77-05836

ON THE RELIABILITY OF METHODS FOR QUANTITATIVE SURVEYS OF FISH LARVAE,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
For primary bibliographic entry see Field 7B.
W77-05837

INVESTIGATIONS ON THE DISTRIBUTION OF FISH LARVAE AND PLANKTON NEAR AND ABOVE THE GREAT METEOR SEAMOUNT,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
W. Nellen.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 213-214.

Descriptors: Population, *Distribution, *Plankton, *Larvae, *Fish populations, *Sampling.
Identifiers: *Great Meteor Seamount.

The Great Meteor Seamount influences the distribution of plankton by forming a barrier to the organisms of the deep scattering layer for horizontal extension. The plankton biomass above the seamount was found to be only 1/3 as great as that found beside it. An analysis of the length distribution of fish larvae showed that above the mount mesopelagic oceanic forms in the plankton hauls were represented only by the smaller specimens. Horizontal ring-trawl hauls done at a depth of 25 m at a permanent station near the mount were different from oblique tows in the frequency of several fish larval types. (See also W77-05821) (Chilton-ORNL)
W77-05838

NEARSHORE DISTRIBUTION OF HAWAIIAN MARINE FISH LARVAE: EFFECTS OF WATER QUALITY, TURBIDITY AND CURRENTS,
Hawaii Inst. of Marine Biology, Honolulu.
For primary bibliographic entry see Field 5C.
W77-05839

VERTICAL AND SEASONAL VARIABILITY OF FISH EGGS AND LARVAE AT OCEAN WEATHER STATION 'INDIA',
Institute for Marine Environmental Research, Edinburgh (England). Oceanographic Lab.
R. Williams, and P. J. B. Hart.
In: The Early Life History of Fish, Vol I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 233-243, 8 fig, 8 ref.

Descriptors: *Distribution, *Environmental effects, *Fish eggs, *Larvae, *Seasonal, Distribution patterns.

At International Ocean Weather Station 'I', fish eggs and larvae were identified for 1971 and 1972 and their vertical and seasonal distributions were plotted. Mean numbers of eggs and larvae from March 31, 1971 to October 6, 1971 were 0.14 eggs and 0.12 larvae/cubic m and for March 24, 1972 to October 11, 1972 were 0.12 eggs and 0.09 larvae per cubic m. Nine species of fish larvae were identified, the most abundant being those of M. muelleri which reached densities of 20 larvae/cubic m in the surface 30 m in September of 1971. The majority of the larvae were found in the upper 200 m in both years. Maurolicus eggs were found between 100 and 500 m with their distribution being correlated with the 9C isotherm. The eggs remained in water between 8.8 and 10C. Maximum densities of 5 eggs/cubic m occurred at 100 m in May, 1972, at 200m in June, 1972 and at 180 m in June-July, 1971. (See also W77-05821) (Chilton-ORNL)
W77-05840

THE FEEDING OF PLAICE AND SAND-EEL LARVAE IN THE SOUTHERN BIGHT IN RELATION TO THE DISTRIBUTION OF THEIR FOOD ORGANISMS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
T. Wyatt.
In: The Early Life History of Fish, Vol I, 1974. Proceedings of an International Symposium held

at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 245-251, 1 tab, 3 fig, 10 ref.

Descriptors: *Distribution, *Environmental effects, *Larvae, Feeding rates, Prey, Foods, *Fish food organisms.
Identifiers: *Plaice, *Sand-eel.

The feeding rates of plaice and sand-eel larvae in the Southern Bight was determined and compared with the distribution of their prey, Oikopleura dioica. Results indicated a decline in feeding at high encounter rates in plaice larvae. This suggests that fish larvae may be adapted to exploit different relative food concentrations. Plaice and sand-eel larvae occurred together for a period of nearly a month and since both fed on Oikopleura, it might be concluded that the two species were competing with one another. Beginning with a high density of prey, the sand-eels could reduce the prey population to a level at which plaice were better able to exploit it. (See also W77-05821) (Chilton-ORNL)
W77-05841

VERTICAL MIGRATIONS OF LARVAE OF THE ATLANTO-SCANDIAN HERRING (CLUPEA HARENGUS L.),
Polyarnyi Nauchno-Issledovatelskii i Proektnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii, Murmansk (USSR).
A. S. Seliverstov.
In: The Early Life History of Fish, Vol I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 253-262, 5 fig, 17 ref.

Descriptors: *Distribution, *Migration, *Vertical migration, Diurnal, Larvae, Fish, *Herrings.

Vertical distribution of herring larvae was studied from data collected at diurnal and standard ichthyoplanktonic stations over a 24 h period. As they passed to external feeding on the second day after hatching, larvae made a characteristic migration to the upper 50m layer. At 6-9 days, larvae started their regular diurnal migrations. The amplitude of diurnal vertical migrations was found to reach 75-100 m. Temperature differences of 1.0-1.5C between top and bottom did not prevent vertical migration. It was concluded that a positive phototaxis at the beginning of feeding which has appeared in the process of evolution provides for migration to the upper layers. (See also W77-05821) (Chilton-ORNL)
W77-05842

SEASONAL VARIATION OF ICHTHYOPLANKTON IN THE ARABIAN SEA IN RELATION TO MONSOONS,
Indian Ocean Biological Centre, Cochin (India); and National Inst. of Oceanography, Cochin (India).
K. J. Peter.
In: The Early Life History of Fish, Vol I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 263-264.

Descriptors: *Distribution patterns, *Seasonal, Fish eggs, Larvae, *Monsoons, *Plankton.
Identifiers: *Ichthyoplankton, *Arabian Sea.

During the southwest monsoon season a slight reduction in areas of normally high concentrations of total fish eggs was noted. During the northeast monsoon other areas which normally had high concentrations were changed into areas of lowest density. Areas of high concentration along the west coast of India were retained without much change. During southwest monsoon season, changes in patterns of distribution of total fish larvae were noticed only along the eastern part of the Arabian Sea. The areas of high abundance for both eggs and larvae coincided with areas of upwell or places that were under the influence of divergences. (See also W77-05821) (Chilton-ORNL)
W77-05843

FOOD AND FEEDING OF LARVAL REDFISH IN THE GULF OF MAINE,
National Marine Fisheries Service, Narragansett, R.I. MARMAP Field Group.
R. R. Marak.
In: The Early Life History of Fish, Vol I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 267-275, 2 fig, 3 tab, 9 ref.

Descriptors: *Metabolism, Foods, Feeding rates, *Larvae, Copepods, Predation, *Fish food organisms.
Identifiers: *Redfish, *Gulf of Maine.

The stomachs of 402 larval redfish taken in an Isaac-Kidd mid-water trawl in the southwestern part of the Gulf of Maine in late July and September 1957 were examined. The major portion of the diet was found to consist of juveniles and adults of copepods and larval copepods. Larvae of 9-18 mm fed on larval copepods and larvae of 18 mm and larger on adult copepods. Composition of food varied between stations and seasons but the quantity of the food did not vary greatly. (See also W77-05821) (Chilton-ORNL)
W77-05844

FOOD OF THE LARVAL ANCHOVETA ENGRAULIS RINGENS J.,
Instituto del Mar del Peru, Lima.
B. R. de Mendiola.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 277-285, 4 tab, 2 fig, 12 ref.

Descriptors: *Metabolism, Foods, *Larvae, Plankton, *Zooplankton, Phytoplankton, Copepods, Size, *Fish food organisms.
Identifiers: *Anchoveta.

The data showed that anchoveta during the larval stage (from 3-30 mm) feed on zooplankton and that the staple food throughout the year is copepods in different stages of development. Analysis of the gut contents of juvenile anchoveta has shown that, at lengths above 46 mm the proportion of phytoplankton in the food steadily increases to a length of about 12 cm when the food is almost entirely phytoplankton. No marked variation in the composition of the food was noted between seasons, although there was in the quantity of food, with the heaviest feeding in summer. (See also W77-05821) (Chilton-ORNL)
W77-05845

LABORATORY STUDIES OF PREDATION BY EUPHAUSIID SHRIMPS ON FISH LARVAE,
National Marine Fisheries Service, La Jolla, Calif. Southwest Fisheries Center.
G. H. Theilacker, and R. Lasker.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 287-299, 5 tab, 4 fig, 30 ref.

Descriptors: *Predation, Foods, *Feeding rates, *Larvae, *Shrimp, Fish, Laboratory investigations.

Data indicates that euphausiid shrimps may be important predators of fish larvae. When the number of yolk-sac anchovy larvae offered was limiting the median number eaten/day by larval E. pacifica was 2; juvenile euphausiids ate 7, and adults 17. Within the adult euphausiid size group, feeding on fish larvae increased with increasing animal size but no size-specific feeding could be demonstrated for juveniles. The amount of feeding was not affected by the addition of another prey, imposed starvation, molting, or the length of time in captivity. The amount of feeding increased as the prey density increased. Feeding rate was not affected by the time of day. When older, more active anchovy larvae were offered the percent of capture was lower. (See also W77-05821) (Chilton-ORNL)
W77-05846

CHEMICAL CHANGES DURING GROWTH AND STARVATION OF HERRING LARVAE,
Dunstaffnage Marine Research Lab., Oban (Scotland).
For primary bibliographic entry see Field 5C.
W77-05847

METABOLISM OF NITROGENOUS WASTES IN THE EGGS AND ALEVINS OF RAINBOW TROUT, SALMO GAIRDNERI RICHARDSON,
Kent State Univ., Ohio. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W77-05848

FEEDING, STARVATION AND WEIGHT CHANGES OF EARLY FISH LARVAE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
For primary bibliographic entry see Field 5C.
W77-05849

QUANTITATIVE NUCLEIC ACID HISTOCHEMISTRY OF THE YOLK SAC SYNCYTIUM OF OVIPAROUS TELEOSTS: IMPLICATIONS FOR HYPOTHESES OF YOLK UTILIZATION,
Clemson Univ., S.C. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-05850

MERCURY IN FISH AND SHELLFISH OF THE NORTHEAST PACIFIC. I. PACIFIC HALIBUT, HIPPOGLOSSUS STENOLEPIS,
National Marine Fisheries Service, Seattle, Wash. Pacific Utilization Research Center.
For primary bibliographic entry see Field 5B.
W77-05865

HISTOPATHOLOGY OF AN ACUTE FIN LESION IN THE SUMMER FLOUNDER, PARALICHTHYS DENTATUS, AND SOME SPECULATIONS ON THE ETIOLOGY OF FIN ROT DISEASE IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Oxford, Md. Middle Atlantic Coastal Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-05870

HEAVY METAL CONCENTRATIONS IN KIDNEYS OF ESTUARINE RACCOONS FROM FLORIDA,
Florida State Dept. of Health and Rehabilitative Services, Tallahassee. Health Program Office.
For primary bibliographic entry see Field 5B.
W77-05871

CHLORINATED HYDROCARBONS AND TOTAL MERCURY IN THE PREY OF THE WHITE-TAILED EAGLE (HALIAEETUS ALBICILLA L.) IN THE QUARKEN STRAITS OF THE GULF OF BOTHNIA, FINLAND,
Kuopio Univ. (Finland). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-05875

PROCEDURE FOR HYGIENIC STUDIES IN DETERMINING LOCAL METHODS FOR PROTECTING WATER RESOURCES OF MARINE BODIES OF WATER, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5B.
W77-05878

CRITICAL SWIMMING SPEEDS OF COHO SALMON (ONCORHYNCHUS KISUTCH) FRY TO SMOLT STAGES IN RELATION TO SALINITY AND TEMPERATURE,
British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.
For primary bibliographic entry see Field 5C.
W77-05880

FATE AND EFFECT OF NAPHTHALENES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Skidaway Inst., of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W77-05894

BIOLOGICAL TRANSPORT OF COPPER AT LOCH EWE AND SAANICH INLET: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5B.
W77-05895

CHANGING LOBSTER ABUNDANCE AND THE DESTRUCTION OF KELP BEDS BY SEA URCHINS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-05902

COMMUNITY STRUCTURE AND THE EFFECTS OF POLLUTION IN SEA-GRASS MEADOWS AND ADJACENT HABITATS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W77-05903

EFFECTS OF A SPILL OF MARINE DIESEL OIL ON THE ROCKY SHORE FAUNA OF LAMMA ISLAND, HONG KONG,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5C.
W77-05906

EFFECTS OF SPECIES, SEX, LENGTH AND LOCALITY ON THE MERCURY CONTENT OF SCHOOL SHARK GALEORHINUS AUSTRALIS (MACLEY) AND THE GUMMY SHARK MUSTELUS ANTARCTICUS GUENTHER FROM SOUTH-EASTERN AUSTRALIAN WATERS,
Victoria Ministry for Conservation, Melbourne (Australia). Fisheries and Wildlife Div.
For primary bibliographic entry see Field 5C.
W77-05908

INGESTION OF SUSPENDED OIL PARTICLES AND THE INFLUENCES ON MORTALITY IN THE MOLLUSCAN LARVAE, (IN JAPANESE),
Nansei Regional Fisheries Research Lab., Maruishi (Japan).
For primary bibliographic entry see Field 5C.
W77-05909

SEWAGE NUTRIENT ENRICHMENT AND PHYTOPLANKTON ECOLOGY ALONG THE CENTRAL COAST OF LEBANON,
American Univ., Beirut, (Lebanon). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-05911

SYNERGISTIC EFFECTS OF CADMIUM AND SALINITY COMBINED WITH CONSTANT AND CYCLING TEMPERATURES ON THE LARVAL DEVELOPMENT OF TWO ESTUARINE CRAB SPECIES,
Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 5C.
W77-05912

COPPER, ZINC AND CADMIUM IN COASTAL WATERS OF THE N.W. MEDITERRANEAN,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W77-05913

TRACE METALS IN SOUTHERN CALIFORNIAN MUSSELS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 5A.
W77-05914

MERCURY IN PLANKTON FROM A POLLUTED NORWEGIAN FJORD,
Norsk Institutt for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W77-05915

RESIDUES OF CHLORINATED HYDROCARBONS IN MARINE ORGANISMS IN RELATION TO SIZE AND ECOLOGICAL PARAMETERS, I. PCB, DDT, DDE AND DDD IN FISHES AND MOLLUSCS FROM THE ENGLISH CHANNEL,
Institut fuer Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 5C.
W77-05917

A TWO-DIMENSIONAL MATHEMATICAL MODEL FOR WATER QUALITY PLANNING IN ESTUARIES,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05926

WAVE-INDUCED CIRCULATION IN SHALLOW BASINS,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-05970

SALT WATER PUMPING CONTROLS SEA WATER INTRUSION,
Ground Water Consultants Group, Edmonton (Alberta).
P. L. Hall, and M. G. Mateyk.
Water and Sewage Works, Vol. 124, No. 2, p 78-81, February 1977. 8 fig, 5 ref.

Descriptors: :Saline water intrusion, *Sea water, *Canada, *Water wells, Saline water-freshwater interfaces, Saline water systems, Saline water, Wells, Fish, Potable water, Model studies, Computer models, On-site investigations, Well casings, Well screens, Corrosion, Groundwater, Aquifers, Groundwater movement, Hydrogeology.
Identifiers: *Salt-water contamination, Freshwater wells, Salt-water wells.

Increasing demands for freshwater by fish plants and townspeople in Shippegan, New Brunswick, resulted in over-pumping and ensuing salt water contamination of freshwater wells in the town. A later extension of harbor facilities threatened offshore salt water intake. A computer model was developed to simulate salt water intrusion resulting from wells located near a shore. Results from the model showed that the regulation of freshwater pumping and the construction of salt water wells near the shore could control salt water intrusion. The construction of salt water wells in Shippegan has demonstrated the feasibility of this method for controlling intrusion. The use of inert materials has prevented corrosion of the wells. However, the corrosion of pumps by salt water still remains a problem. (Sims - ISWS)
W77-05972

AN HIERARCHICAL GOAL PROGRAMMING APPROACH TO ENVIRONMENTAL-LAND USE MANAGEMENT,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6G.
W77-05979

DISSOLVED GAS SATURATION ANOMALIES AND EXCESS HELIUM IN THE OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5A.
W77-06024

CALIFORNIA--'SAVING THE COAST',
For primary bibliographic entry see Field 6G.
W77-06048

ACHIEVEMENTS IN MARINE CONSERVATION, 1. MARINE PARKS,
International Union for Conservation of Nature and Natural Resources, Morges (Switzerland). Commission on Ecology.
For primary bibliographic entry see Field 5G.
W77-06049

CLOSED-CYCLE MARICULTURE IN MARYLAND, VIRGINIA, AND DELAWARE: AN EXAMINATION OF THE ADAPTABILITY OF EXISTING FISHERY LAWS TO NEW TECHNOLOGY,
Delaware Univ., Newark. Sea Grant Program.
For primary bibliographic entry see Field 6E.
W77-06052

SURGE EFFECTS FROM HURRICANE ELOISE,
Army Engineer District, Mobile, Ala. Navigation and Coastal Branch.
W. W. Burdin.
In: Proceedings of Mississippi Water Resources Conference 1976, p 1-18, 18 fig, 3 ref.

Descriptors: *Hurricanes, *Surges, *Damages, *Florida, Gulf of Mexico, Winds, Coasts, Dunes, Storms, Beaches, Protection, Bulkheads, Erosion, Tidal energy, Waves(Water), Tides, Disasters, Coastal structures.
Identifiers: *Hurricane Eloise.

Hurricane Eloise struck the Florida gulf Coast in September 1975 with the heaviest damage occurring in the Panama City area. At landfall, Eloise, classed as a Category 3 storm, had an observed minimum pressure of 955 mbar, maximum sustained winds of 110 knots, a forward speed of 23 knots, an eye diameter of 20 nautical miles, and a radius of maximum winds of 20 nautical miles. Although the Weather Service forecast a 10-foot surge for Eloise, the actual high water elevation was 15-16 feet mean sea level. The author analyzes the method of computing surge forecasts and suggests further research to find the cause of the dis-

crepancy between the forecast and the actual surge. Eight pages of photographs of the storm and its damage to the Panama City beaches are included. The author notes that the difference in severity of damages between Eloise in Florida and Camille on the Mississsippi Gulf Coast was due to Florida's protective dune line. (See also W77-06084) (Capehart-Florida)
W77-06085

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE LOK ON PAI DESALTING PLANT - HONG KC. G,
H. J. Woodthorpe.
Water Services, Vol 80, No. 965, p 412-418, July, 1976.

Descriptors: *Desalination plants, Desalination apparatus, Desalination processes, *Desalination wastes, *Impaired water use, Desalination, Water supply, Water resources, Water sources, Municipal water, Water storage, Reservoir storage, Water resources development, Water supply development, *Salinity, Sea water, *Waste water treatment, *Corrosion control, Distillation, *Flash distillation.

The world's largest desalination plant was opened last year in Hong Kong. The background of the plant, water demand of the area, and operation of the facility are discussed. An experimental program was conducted to investigate various factors prior to construction of the plant. These included (1) the fluctuation in the salinity of the seawater in the river estuary, (2) the corrosive and erosive effects of local seawater on conventional construction materials and (3) the effect of desalted waters on old and new water mains. Details of the plant design are given. It utilizes a cross-tube multistage flash distillation procedure. There are six evaporator units. Corrosion is the most serious single problem in seawater distillation, thus control of brine chemistry is crucial. Costs and financing of the plant are also presented and evaluated. (Jamail-Arizona)
W77-05940

3B. Water Yield Improvement

SOIL SEALING METHOD,
American Colloid Co., Skokie, Ill. (Assignee).
J. Hughes.
U.S. Patent No. 3,986,365, 3 p, 3 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 963, October 19, 1976.

Descriptors: *Patents, *Seepage control, *Water control, *Soil sealants, Sealants, Bentonite, Montmorillonite, Polymers.
Identifiers: Polyacrylic acid.

This invention is predicated on the discovery that when a water-soluble polymer is added to bentonite, in certain amounts, the resulting composition when added to soil requires 50-60% less bentonite in order to prevent seepage of water. The principal object is to provide a method for forming lagoons, irrigation ditches, and other water holding areas which will not allow seepage. The bentonite utilized is one which will hydrate in the presence of water. A preferred bentonite is sodium bentonite which is basically a hydratable montmorillonite clay which has sodium as its predominate exchangeable ion. However, the bentonite useful in forming water holding areas may also contain other cations such as calcium, magnesium and iron. The water-soluble polymer is preferably polyacrylic acid, water-soluble salts of polyacrylic acid, polymethacrylic acid, water-soluble salts thereof, and acylic copolymers formed from either acrylic acid or methacrylic acid. (Sinha-OEIS)
W77-05657

ALTERNATE METHODS OF AVALANCHE CONTROL (INTERIM) (1974-1975),
Washington Univ., Seattle. Geophysics Program; and Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W77-05810

THE AMERICAN EXPERIENCE,
For primary bibliographic entry see Field 6G.
W77-05941

HYDROLOGY FOR SOIL AND WATER CONSERVATION IN THE COASTAL REGIONS OF NORTH AFRICA--EXAMPLE OF A HYDROLOGICAL TECHNIQUE FOR SMALL BASINS,
Soil Conservation Service, Washington, D.C. Engineering Div.
In: FAO Conservation guide 2, Hydrological Techniques for Upstream Conservation, Rome, Italy, 1976. p 53-65, 4 fig, 5 tab, 5 ref. S. H. Kunkle, J. L. Thames, ed.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Storm water, *Design storm, *Soil conservation, *Water conservation, *Africa, Basins, Hydrology, Precipitation(Atmospheric), Rainfall, Drainage area, Drainage, Evapotranspiration, Hydrologic aspects, Climatic data, Storms, Runoff, Watershed management, Distribution patterns, Rainfall.
Identifiers: North Africa(Coastal regions).

Procedures for estimating precipitation and runoff relationships on small drainage areas are presented. Although designed for the planning of small soil and water conservation projects in North Africa, they are applicable to areas with similar climatic conditions. Catchment characteristics of a watershed are evaluated in order to estimate the volume of runoff at a designated point; the extent to which the soil, land use, vegetative cover and land treatment measures affect storm runoff is taken into account; the soil is divided into four hydrologic groups according to runoff producing potential. The sequence of crops on the cultivated portion of the catchment is evaluated on the basis of hydrologic effects. Storm rainfall patterns are discussed and the procedure for estimating the volume of storm runoff is presented. (Jamail-Arizona)
W77-05945

HARVESTING SURFACE RUNOFF AND EPHEMERAL STREAMFLOW IN ARID ZONES,
National Centre for Arid Zone Studies, Saltillo, (Mexico).
J. Medina.
In: FAO Conservation Guide 3, Conservation in Arid and Semiarid Zones, Rome, Italy, 1976. p 61-72 11 fig, 10 ref.

Descriptors: *Water harvesting, *Arid lands, *Water storage, *Surface runoff, *Water yield improvement, Water yield, Runoff, Ephemeral streams, Soil surfaces, Stock water, Water conservation, Rainfall-runoff relationships, Rain water, Water supply, Storage, Surface-groundwater relationships.

Water harvesting is an ancient technique used to provide water for small agricultural operations, stock use, or domestic needs. Surface harvesting and catchment techniques are presented and maintenance problems of a water harvesting system described. Four methods of surface harvesting are discussed: (1) naturally impervious surfaces, (2) land alteration, (3) chemical soil surface treatments, and (4) groundcovers. Associated costs, and performance and maintenance requirements which influence the suitability for particular users and sites of each method are evaluated. The factor of catchment shape is also presented. A complete harvesting system includes a means to store the collected water. There are three basic storage systems: (1) excavated pits or ponds, (2) bags made of rubber or plastic, and (3) tanks of steel or concrete. The most appropriate system for a particular site depends upon local conditions of soils, site accessibility, available materials, and cost of labor and material. Excavated pits are the most common type of water storage system. Water spreading as a means of utilizing ephemeral streamflow for production of crops or forage is evaluated. (Jamail-Arizona)
W77-05946

RAINFALL RESULTS, 1970-1975: FLORIDA AREA CUMULUS EXPERIMENT,
National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
W. L. Woodley, J. Simpson, R. Biondini, and J. Berkeley.
Science, Vol. 195, No. 4280, p 735-742, February 25, 1977. 1 fig, 5 tab, 16 ref. NSF GI-43764.

Descriptors: *Weather modification, *Cloud seeding, *Rainfall, *Florida, Silver iodide, Nucleation, Convection, Cloud physics, Mathematical models, On-site investigations, Aircraft, Artificial precipitation, Precipitation(Atmospheric), Clouds, Radar, Data processing, Meteorology.
Identifiers: Massive seeding, Convective clouds.

The latest rainfall results of the Florida Area Cumulus Experiment (FACE) were discussed after a review of the background, design and early results of the experiment. Analysis, without the benefit of data stratification and appropriate covariates of the 48 random experimentation days obtained through 1975, provided no evidence that dynamic seeding appreciably altered the rainfall over the fixed target area (13,000 sq km). Partitioning of the experimentation days, according to whether the convective echoes moved across the Florida peninsula or developed in situ, was more informative. Use of this echo motion covariate with five meaningful predictor models of natural rainfall in a stepwise regression program produced persuasive evidence for an effect of seeding in both echo motion categories. For days with moving echoes, there is evidence for a positive, statistically significant treatment effect on the rainfall from the subject clouds (the floating target) and in the overall target area. The results for days with stationary echoes, although considerably more tentative, suggest that seeding produced more rainfall in the floating target but with no net change of the precipitation in the overall target area. The ramifications of this result and a possible explanation were discussed. Corroborative statistical analyses and discussion were presented, including a discussion of the physical bases and history of the echo motion convariate and the meteorological predictors, analysis that is supportive of the rain-gage-adjusted radar measurements of precipitation in FACE and results of relevant cloud physics measurements in Florida. (Sims-ISWS)
W77-05975

THE 1974 SKYWATER WORKSHOP,
RAND Corp., Santa Monica, Calif.
F. W. Murray.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A019 346, Price codes: A03 in paper copy, A01 in microfiche. Rand Paper P-5289, August 1974. 28 p, 2 tab, append.

Descriptors: *Weather modification, *Model studies, *Cloud seeding, *Conferences, Mathematical models, Computer models, Cloud physics, Precipitation(Atmospheric), Design, Evaluation,

Planning, Meteorology, Rain, Snow, Water supply, Water resources.
Identifiers: *Skywater, Experiment design, *High Plains Cooperative Experiment.

The Division of Atmospheric Water Resources Management of the Bureau of Reclamation has received authorization and funding to set up and operate the High Plains Cooperative Experiment with the primary aim of determining the feasibility of augmenting precipitation in the High Plains region by artificial means. In order to take advantage of the widest range of technical expertise in planning the experiment, the 1974 Skywater Workshop was convened in Vail, Colorado, on 22-25 July 1974. Approximately 40 visiting scientists and 8 host members of the Bureau of Reclamation participated in a series of roung table discussions, mainly in three interest groups--design and evaluation, measurements, and modeling--but with frequent general sessions. This paper consisted of the author's notes taken at the generagl and modeling sessions and some personal comments. Its intended use is to assist the Bureau of Reclamation personnel in preparing the official Proceedings of the Workshop. (Sims-ISWS)
W77-05976

3C. Use Of Water Of Impaired Quality

EVALUATION OF AGRICULTURAL ADJUSTMENT TO IRRIGATION WATER SALINITY: A CASE STUDY FOR PINAL COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
M. A. Boster.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 106, Price codes: A09 in paper copy, A01 in microfiche. Ph.D. Dissertation, 1976. 180 p. OWRT A-048-ARIZ(3), 14-31-0001-4003.

Descriptors: *Watershed management, *Decision making, Flood control, Irrigation, *Water yield, Sediment yield, Optimization, Snowmelt runoff, *Arizona, *Stochastic processes, *Model studies, *Irrigation water.
Identifiers: Vegetation management, Bayesian analyses.

The primary purpose was to develop a methodology for watershed managers to use in resource development and conservation decision making. Stochastic event-based precipitation models were derived to serve as inputs into deterministic watershed models with the result that a time series of hydrologic outputs could be obtained. These outputs, water and sediment yields and peak flow rates, could then be used to reflect the extent of man's activities in modifying the environment, as well as, for the optimal design and operation of water control facilities. The effort was directed for moderate-sized watersheds where little or no streamflow data was available, but precipitation information could be obtained from onsite or nearby locations. A variety of problems were modeled by this approach, such as, predicting snowmelt runoff, modeling hydrologic effects of land use changes, stochastic analyses of water yield increase from vegetation management, and the design of floodwater retarding structures. The project demonstrated that inventory control techniques could be adapted for obtaining an optimal irrigation policy, i,e., one that maximizes net returns to farmers. Bayesian decision theory was used in conjunction with event-based precipitation models for obtaning the design of a structure tailored to a specific problem rather than using pre-specified criteria such as the 100-year flood.
W77-05733

PREDICTED EFFECTS OF A PROPOSED WATER-RESOURCE MANAGEMENT PLAN IN THELOWER SAN LUIS REY RIVER VALLEY, CALIFORNIA, USING DIGITAL GROUND-WATER FLOW MODELS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05755

CHEMICAL QUALITY OF GROUND WATER IN THE TEHAMA-COLUSA CANAL SERVICE AREA, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-05756

LEACHING OF A HIGHLY SALINE-SODIC SOIL,
Agricultural Univ., Wageningen (Netherlands). Dept. of Soils and Fertilizers.
For primary bibliographic entry see Field 2G.
W77-05788

PROCEEDINGS OF THE CONFERENCE ON SALT AND SALINITY MANAGEMENT,
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 5G.
W77-05934

THE LOK ON PAI DESALTING PLANT - HONG KONG,
For primary bibliographic entry see Field 3A.
W77-05940

EFFECT OF SULFURIC ACID ON SODIUM-HAZARD OF IRRIGATION WATER,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W77-05942

CHEMICAL ACTIVATION OF GROUND-WATERS OF THE INGUL-VISUN' INTER-FLUVE WITHIN THE YAVKINSK IRRIGATION SYSTEM, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W77-05952

SOILS OF THE TEDZEN-HURGHAB INTER-FLUVIAL AREA, (IN RUSSIAN),
Desert Inst., Ashkhabad (USSR).
For primary bibliographic entry see Field 2G.
W77-05960

INFLUENCE OF SALINITY AND N-P FERTILITY LEVELS ON MINERAL CONTENT AND GROWTH OF SORGHUM IN SAND CULTURE,
California Univ., Riverside. Dept. of Soil Science and Agricultural Engineering.
P. M. Patel, A. Wallace, and E. F. Wallihan.
Agronomy Journal, Vol 67, No 5, p 622-625, September-October 1975. 1 fig, 3 tab, 19 ref.

Descriptors: *Grain sorghum, *Soil salinity, *Salinity, *Crop response, Irrigation, Irrigation effects, Crop production, Agriculture, Salt tolerance, Fertilizers, Fertilization, *Nitrogen, Sands, *Phosphorus.

Plant growth is characteristically depressed at certain levels of salt concentrations yet it sometimes responds to fertilizers even though growth depression can be expected to reduce nutrient requirements and even though fertilizer application increases salinity to some degree. This study was designed to examine tension zones involving interactions between nutrient supply (N and P) and salt concentrations. Grain sorghum was chosen for this study because it is commonly grown in regions of irrigated agriculture where soil salinity is often a problem. Plants were grown to maturity in automatically operated sand culture equipment at two levels each of N and P, each subjected to added Ca-Na chloride salinity levels of zero, medium (EC=10 mmho/cm) and high (EC=20 mmho/cm). Vegetative growth was depressed to about 50% of control at both medium and high salinity, while grain production was depressed to about 35% at medium salinity and to almost none at high salinity. (Skogerboe-Colo St)
W77-06094

CONTROL OF WATER POLLUTION FROM CROPLAND, VOLUME 1--A MANUAL FOR GUIDELINE DEVELOPMENT,
Agricultural Research Service, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06097

SCIENTIFIC IRRIGATION SCHEDULING FOR SALINITY CONTROL OF IRRIGATION RETURN FLOWS,
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5G.
W77-06098

3D. Conservation In Domestic and Municipal Use

EFFLUENT WASTE TREATMENT PROCESS AND APPARATUS,
Sphere, Inc., Bedford, N.Y. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05665

QUALITY CHARACTERISTICS OF URBAN STORM WATER IN SYDNEY, AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05963

WATER USE BY IRRIGATED COTTON IN THE SUDAN IV. WATER USE POTENTIAL EVAPORATION AND YIELD,
Cotton Research Corp., Namulonge (Uganda). Cotton Research Station.
For primary bibliographic entry see Field 3F.
W77-05982

A GEOGRAPHICAL SYSTEMS ANALYSIS OF THE WATER DISPOSAL NETWORKS OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York. Dept. of Geography.
For primary bibliographic entry see Field 5D.
W77-05985

3E. Conservation In Industry

METHOD FOR REMOVING METALS FROM DILUTE AQUEOUS SOLUTIONS,
Texaco Inc., New York. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05654

RECOVERY OF CHROMATES BY MEMBRANE,
Monsanto Co., St. Louis, Mo. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05661

EFFLUENT WASTE TREATMENT PROCESS AND APPARATUS,
Sphere, Inc., Bedford, N.Y. (Assignee).

For primary bibliographic entry see Field 5D.
W77-05665

WATER RESOURCES ISSUES FOR A GROWING COAL INDUSTRY,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6D.
W77-05675

PURIFICATION OF WASTE WATERS FROM THE MANUFACTURE OF RAG PULP-CONTAINING PAPER (OCHISTKA STOCHNYKH VOD OT PROIZVODSTVA BUMAGI S ISPOL' ZOVANIEM TRYAPICHNOI POLUMASSY),
Ukrainskii Nauchno-Issledovatelskii Institut Bumagi, Kiev (USSR).
For primary bibliographic entry see Field 5D.
W77-05683

THE CONSUMPTION OF WATER IN THE PAPER INDUSTRY (I1 CONSUMO D'ACQUA NELL'INDUSTRIA CARTARIA),
Il Cartaio, No. 5, p 9-10, September/October, 1976.

Descriptors: *Pulp and paper industry, *Water conservation, Water reuse, Recycling, Water pollution control, Industrial water, Pollution abatement, Recirculated water.
Identifiers: Waste paper.

The trend toward reduced water consumption in the paper industry is briefly noted, particularly as it relates to the growing pressure for pollution control. Indications are that through recycling of stock-preparation and groundwood-mill process water, a paper mill should be able to operate at a water consumption level of 70-100 liters/kg of paper produced. Some instances where mills have attained even lower levels are cited. Water recycling can be complicated by the use of waste paper as a fiber source. (Speckhard-IPC)
W77-05684

BIOLOGICAL POSSIBILITIES FOR WASTE WATER PURIFICATION (CONSIDERATII ASUPRA POSIBILITATILOR BIOLOGICE DE PURIFICARE A APELOR REZIDUALE),
For primary bibliographic entry see Field 5G.
W77-05685

CLOSED-CYCLE UTILIZATION OF FERMENTATION INDUSTRY EFFLUENTS (ZAMKNUTYI TSIKL ISPOL'ZOVANIYA OTKHODOV GIDROLIZNOGO PROIZVODSTVA),
Kirovskii Biokhimicheskii Zavod (USSR).
For primary bibliographic entry see Field 5D.
W77-05689

NEW IN-PLANT TECHNOLOGY TO REDUCE POLLUTION FROM A SODIUM BASE SULPHITE MILL,
MoDoCell A. B., Ornskoldsvik (Sweden).
For primary bibliographic entry see Field 5D.
W77-05699

ENVIRONMENTAL PROTECTION COSTS IN THE SWEDISH PULP AND PAPER INDUSTRY (MILJOVARDSKOSTNADER I SVENSK MASSA-OCH PAPPERSINDUSTRI),
For primary bibliographic entry see Field 5D.
W77-05701

WATER REUSE IN 100% SECONDARY FIBRE PULPING MILL,
Brown Co., Eau Claire, Wis.
For primary bibliographic entry see Field 5D.
W77-05705

TREATMENT OF EFFLUENT FROM SECONDARY FIBRE MILLS,
Van Luven Consultants Ltd., Montreal (Quebec).
For primary bibliographic entry see Field 5D.
W77-05706

PROCEEDINGS OF SEMINARS ON WATER POLLUTION ABATEMENT TECHNOLOGY IN THE PULP AND PAPER INDUSTRY.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W77-05708

SPECIALIZED INTERNAL PRACTICES (FOR POLLUTION ABATEMENT),
For primary bibliographic entry see Field 5D.
W77-05715

PREPARATION AND EVALUATION OF IMMOBOLIZED SINGLE AND MULTIPLE ENZYME SYSTEMS,
Nebraska Univ., Lincoln. Dept. of Food Science and Technology.
A. Kilara.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 898, Price codes: A08 in paper copy, A01 in microfiche. Ph.D. Thesis, October 1976. 155 p, 4 append. OWRT A-040-NEB(1). 14-34-0001-6028.

Descriptors: *Enzymes, Bioassay, *Chemical reactions, Solubility hydrolysis, *Proteins, *Lipids, *Kinetics, Temperature, Hydrogen ion concentration, *Food processing industry, Recycling.
Identifiers: *Cheese whey, *Lactose, *Lactose, *Lipose, *Papain.

This study demonstrated that the enzymes lactase, papain and lipase could be immobilized, either singly or concomitantly, on derivatized Sepharose 4-B (4% agarose gel beads). Sepharose 4-B was activated by cyanogen-bromide and then allowed to react with ethylenediamine and succinic anhydride to obtain succiny laminoethyl agarose. The enzymes were coupled to the succinylaminoethyl agarose with a water insoluble carbodiimide reaction. The effects of immobilization on the pH and temperature of assay and kinetic parameters such as apparent Michaelis constant (Kmapp) and apparent maximal velocity (V app) for each enzyme were investigated. Immobilization of lactase did not alter the pH optimum for assay. The pH optimum for assay of soluble and immobilized single or multiple lactase was 7.0. The temperature optimum of lactase imnmobilized single was 5C lower than that of soluble lactase. Lactase immobilized in the multiple enzyme system had a temperature optimum 10C higher than the temperature optimum of 30C for soluble lactase. The Kmapp values were changed. The immobilized enzyme systems exhibited superior storage stabilities at pH 7.5 and 4C for periods of up to 8 months. The soluble enzymes under similar storage conditions were observed to lose their activity within 96 hr. It was felt the immobilized multiple enzyme system could be successfully used for the hydrolysis of lactose, proteins and lipids in cheese whey.
W77-05724

GROUND WATER PROBLEMS WITH OIL SHALE MINING IN THE PICEANCE BASIN,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-06045

PREDICTIVE WATER DEMAND MODEL FOR CENTRAL AND SOUTHERN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach. Resources Planning Dept.
For primary bibliographic entry see Field 6D.
W77-06047

PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06055

CANNED AND PRESERVED SEAFOOD PROCESSING POINT SOURCE CATEGORY, EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06057

3F. Conservation In Agriculture

SPRAYING APPARATUS,
R. O. Nugent.
U.S. Patent No. 3,986,671, 10 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 1066, October 19, 1976.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, *Irrigation efficiency, Water distribution(Applied), Application equipment, Jets.

A sprinkler is provided which will disperse the water jet to provide a more even fall-out over the entire watering circle and which will be readily adjustable so that an operator may control the watering effect to suit the particular conditions. Also an assembly is provided in which the trajectory of the water spray may be easily varied without the need to interchange parts. The sprinkler has a water inlet housing supporting an outlet nozzle assembly for pivotal movement about a vertical support axis. Water supplied to the housing is discharged through the outlet nozzle assembly as a jet of water having a discharge axis inclined to the support axis, flow deflecting means biased for movement to a position for engaging the jet of water to deflect it and to cause rotation of a nozzle in the opoosite direction about the axis. A deflecting blade and driving vane are included to provide an even fall-out of water around the periphery of the watered circle. (Sinha-OEIS)
W77-05659

IRRIGATION SYSTEM OPERATING POLICIES FOR MATURE TEA IN MALAWI,
Institute for Agricultural Research, Zaria (Nigeria).
R. W. Palmer-Jones.
Water Resources Research, Vol. 13, No. 1, p 1-7, February 1977. 2 fig, 3 tab, 15 ref.

Descriptors: *Irrigation systems, *Crop response, *Soil moisture, *Dynamic programming, Optimization, Effects, Rainfall, Equations, Mathematical models, Simulation analysis, Systems analysis, Water supply, Operations.
Identifiers: *Operating policy, *Tea, Water application, Water deficit, *Malawi.

The technical specification of plant-water relationships has led to errors in the formulation of response models for water inputs. Consequently, the optimizing procedures making use of these models may have been misleasing as to both the practical water application rules recommended and the usefulness of the optimizing procedure. In this paper, it is shown that the distribution of water within the root zone, specifically for tea in Malawi, plays an important part in determing response to irrigation. This means that two or more soil moisture state variables will be necessary in the dynamic programming (DP) method of finding the optimal application policy, and this makes DP even more difficult to use in practice than has been previously indicated. It is shown that response to irrigation depends on the amount

of water in the uppermost layer of the soil and that the effect of an irrigation on yield is through its effect on the current level of this variable and on its future levels through the effect of current irrigation on the water contents of lower layers of the soil. Optimal applications are found to be determined by two variables: the water content of the uppermost layer (30 cm) and the water content of the remainder of the root zone. The optimal system distribution policy capacity is found to be close to the level that would just replace the maximum deficit that could build up in the uppermost layer between irrigation rounds. (Bell-Cornell)
W77-05920

GETTING WATER FROM THE SUN,
Arizona Univ., Tucson. Dept. of Soils Water and Engineering.
D. L. Larson, and C. D. Sands II.
Progressive Agriculture in Arizona, Vol. 28, No. 4, p 10-17, Fall, 1976. 3 ref.

Descriptors: *Energy transfer, *Energy conversion, *Irrigation operation and maintenance, *Maintenance costs, *Pumping, Energy, Irrigation, *Irrigation engineering, *Arizona, Irrigation systems, Irrigation efficiency, Pumps.
Identifiers: *Solar energy.

The use of solar energy to provide power for irrigation pumps is discussed. With shortages of both oil and natural gas, solar energy is being looked to as an alternative energy source. The initial investment for solar energy is high and irrigation pumps could be run only during the hours of sunlight, not 24 hours a day as many Southwestern farmers do. These factors are evaluated. The efficiency of a solar energy unit is most important because the more efficient it is, the smaller the collector can be, and the collector is the major investment. The two major components of overall efficiency, the collection efficiency and conversion efficiency, are discussed. Various means of integrating solar energy use with existing practices of farmers in the southwest are presented and evaluated. The conclusion is reached that the southwest will see solar energy power pumps when that energy form becomes competitive, or when alternative sources of power become unavailable. (Jamail-Arizona).
W77-05937

THE AMERICAN EXPERIENCE,
For primary bibliographic entry see Field 6G.
W77-05941

MANAGEMENT AND REGENERATION OF DEGRADED CATCHMENTS AND ERODED PASTORAL LANDS WITH PARTICULAR REFERENCE TO RANGE RESEEDING,
Western Australia Dept. of Agriculture, South Perth.
For primary bibliographic entry see Field 4D.
W77-05947

WATER USE BY IRRIGATED COTTON IN THE SUDAN IV. WATER USE POTENTIAL EVAPORATION AND YIELD,
Cotton Research Corp., Namulonge (Uganda). Cotton Research Station.
D. A. Rijks.
The Journal of Applied Ecology, Vol. 13, No. 2, p 491-506, August, 1976. 3 fig, 3 tab, 40 ref, append.

Descriptors: *Water utilization, *Consumptive use, *Crop response, *Irrigation practices, *Moisture meters, Cotton, Irrigation, Irrigation water, Soil water, Micrometeorology, Crop production, Advection, Drying, *Evaporation, Lysimeters, Water requirements, Moisture content, Evapotranspiration, Gravimetric analysis.
Identifiers: *Sudan.

A study was conducted in the Sudan Gezira to determine the effects of advection on water use within irrigated areas. Water use was estimated by three methods. Two of those, gravimetric sampling of soil water and lysimetry, are discussed. In the gravimetric sampling, samples were collected just before each irrigation and just after and were brought to the laboratory in plastic bags, weighed, and oven dried; moisture content was determined. Bulk density and permanent wilting percentage were also measured. Lysimeter measurements were recorded. The results of these measurements and a discussion of the advantages and limitations of using a lysimeter are presented. The total water required for maximum crop growth can be estimated if potential evaporation, as calculated from Penman's formula, is known. The practical implications of the research conducted are presented. The most serious limitations of the methods used are discussed. Other conclusions presented include: (1) waterlogging decreased crop growth soon after some irrigations but insufficient water was available for optimum crop growth in the latter part of most irrigation cycles, (2) shortage of water was most pronounced near the leading edge so that yield was smaller and was produced at the upwind end, and (3) modifications of irrigation practice are suggested to increase yield near the leading edge. (See also W73-09473;W69-06756) (Jamail-Arizona)
W77-05982

AN EVALUATION OF A RESISTANCE FORM OF THE ENERGY BALANCE TO ESTIMATE EVAPOTRANSPIRATION,
Kansas State Univ., Manhattan. Dept. of Agronomy.
For primary bibliographic entry see Field 2D.
W77-05990

IMPLICATIONS OF RISING ENERGY COSTS FOR IRRIGATED FARMS IN THE OKLAHOMA PANHANDLE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
H. P. Mapp, Jr., and C. L. Dobbins.
American Journal of Agricultural Economics, Vol. 58, No. 5, Proceedings Issue, p 971-977, December 1976. 3 tab, 2 fig, 10 ref. OWRT A-057-OKLA(3). 14-34-0001-6037.

Descriptors: *Agriculture, *Economics, *Irrigation, Water resources, Effects, *Prices, *Natural gas, Crop production, Net income, Pumping, Wells, Linear programming, Optimization, Water policy, Equations, Systems analysis, *Oklahoma.
Identifiers: Water quantity, Tillage practices.

This paper examines the impact of rising natural gas prices on the pattern of irrigated crop production, net farm income, and the quantity of water pumped through time for representative farms under various sets of assumptions regarding water resource situations, crop prices, and tillage pratices. The geographic setting for this analysis is the Oklahoma Panhandle and the Ogallala aquifer. Resource requirements, costs, and returns are estimated peracre for both conventional and reduced tillage methods of production. The analysis uses two sets of crop prices: low and high. Representative farm situations are defined for three--poor, moderate, and good--water resource situations. Using a recursive linear programming model, optimum organizations are determined for a series of five-year periods based on well yields and pumping costs at the beginning of the period. A comparison of the optimal production organizations under constant and rising natural gas prices for representative farms using only conventional tillage practices is given. The implications of product price variations are quite similar for farms across all three water resource situations. High product prices encourage more intensive irrigation practices, other things being equal. Rising natural gas prices increase the cost of pumping irrigation water and reduce the level of net returns associated with irrigated crop production. (Bell-Cornell)
W77-05995

TIME-DEPENDENT LINEARIZED INFILTRATION: III. STRIP AND DISC SOURCES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
A. W. Warrick, and D. O. Lomen.
Soil Science Society of America Journal, Vol. 40, No. 5, p 639-643, September-October 1976. 3 fig, 12 ref. OWRT B-035-ARIZ(6).

Descriptors: *Infiltration, *Irrigation, *Soil water, Model studies, Mathematical studies, Mathematical models, Analytical techniques, Flow, Soil water movement, Mathematics, Equations, Soil science.
Identifiers: *Trickle irrigation, Disc sources, Matric flux potential.

Water flow from strip and disc surface sources was analyzed, using an approach similar to previous investigations with line and point sources. A line of closely spaced trickle irrigation emitters often wets a surface strip of finite width; similarly, for a single emitter, the surface wetted pattern is a disc. Lines of equal matric flux potential are wider and shallower for these sources than wetting patterns for the line and point. The moisture regime is independent of the source shape and depends only on the total flow rate for regions beyond approximately two times the strip width or disc radius. (See also W76-03007 and W74-10217) (Sims - ISWS)
W77-06011

PREDICTIVE WATER DEMAND MODEL FOR CENTRAL AND SOUTHERN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach. Resources Planning Dept.
For primary bibliographic entry see Field 6D.
W77-06047

UREA AND AMMONIUM NITRATE; EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06056

EFFECTS OF UNEVEN SPREADING OF FERTILIZER ON CROP YIELDS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
J. A. Lutz, Jr., G. D. Jones, G. W. Hawkins, and T. B. Hutcheson.
Agronomy Journal, Vol 67, No 4, p 526-529, July-August 1975. 3 fig, 7 tab, 5 ref.

Descriptors: *Fertilization, *Fertilizers, *Nutrients, Crop response, *Crop production, Virginia, Corn(Field), Barley, Soybeans, Wheat.

Bulk spreading of fertilizer does not always result in a uniform distribution over the entire area. The extent to which this distribution affects crop yield is unknown and shoul be investigated. As a result, nine experiments were conducted over a period of several years to determine the effects of uneven distribution of fertilizer on the yield of corn, barley, soybeans, and wheat. The investigations were conducted in the three physiographic areas of Virginia. Soil types varied from thick surface phase sandy loams to a clay loam. Four spread patterns commonly obtained in farming operations and a no-fertilizer treatment were used. In 1970, corn on Frederick silt loam and Tatum silt loam responded to fertilization, but there was no significant differences in yields among spread patterns on Lodi loam. Significant differences in yields among spread patterns on Davidson clay loam were observed. (Skogerboe-Colo St)
W77-06091

RESPONSE OF TWO PEANUT CULTIVARS TO IRRIGATION AND KYLAR,
Agricultural Research Center, Marianna, Fla.
D. W. Gorbet, and F. M. Rhoads.
Agronomy Journal, Vol 67, No 3, p 373-376, May-June 1975. 1 fig, 4 tab, 10 ref.

Descriptors: *Peanuts, Irrigation, *Irrigation practices, Irrigation effects, Crop production, *Crop response, Tensiometers.
Identifiers: *Growth regulator(Kylar).

With improved yields resulting from new cultivars and production practices, irrigation of peanuts is receiving increased attention. The objective of this study was to measure the response of two peanut cultivars to soil-water management in the plow layer and to the growth regulator Kylar. Tensiometers were utilized to schedule irrigations for treatments in which soil moisture tension in the plow layer (20 cm) was maintained below 1 bar. In one treatment, plant wilt at midday was used as an indicator for irrigation. Kylar was applied in some treatments to reduce vegetative development. Total pod production of both cultivars was increased with irrigation, especially in dry seasons. (Skogerboe-Colo St)
W77-06092

CORN YIELD AND NUTRIENT UPTAKE AS AFFECTED BY WATER-TABLE DEPTH AND SOIL SUBMERGENCE,
Punjab Agricultural Univ., Ludhiana (India).
T. N. Chaudhary, V. K. Bhatnagar, and S. S. Prihar.
Agronomy Journal, Vol. 67, No. 6, p 745-749, November-December 1975. 4 fig, 4 tab, 16 ref.

Descriptors: *Water table, *Corn(Field), *Nutrients, Irrigation, Drainage, Crop response, Fertilization, *Crop production, Soils, Water table fluctuations.
Identifiers: *Soil submergence.

Crops are affected by fluctuations in the water table by seasonal rainfall and soil submergence during growth. A better understanding of their response will help us to optimize drainage and irrigation. Response of irrigated corn to (1) four static water-table depths (60, 90, 120, and 150 cm) as affected by the growing-season rainfall and (2) single or repeated submergence for 1 to 6 days was studied in 58 cm diam by 183-cm long metal barrels using silt loam soil during 1971 and 1972. Crop response to water-table depths varied with rainfall during growth. In a wet year, water table at the 120 cm depth gave the highest and that at the 60 cm depth the lowest yield. In a relatively dry year, yield was highest with water tables at 60 and 90 cm depths and decreased with deeper water tables. It is indicated that a water table at 120 cm depth is desirable for corn. (Skogerboe-Colo St)
W77-06095

FINAL REPORT ON FERTILIZER MOVEMENT THROUGH SOIL RESULTING FROM RAINFALL,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
For primary bibliographic entry see Field 5B.
W77-06096

SCIENTIFIC IRRIGATION SCHEDULING FOR SALINITY CONTROL OF IRRIGATION RETURN FLOWS,
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5G.
W77-06098

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DISPERSION PROCESSES IN CIRCULAR OPEN-CHANNEL FLOWS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8B.
W77-05601

SOIL SEALING METHOD,
American Colloid Co., Skokie, Ill. (Assignee).
For primary bibliographic entry see Field 3B.
W77-05657

RIVER TURBINE,
W. J. Mouton Jr., and D. F. Thompson.
U.S. Patent No. 3,986,787, 15 p, 18 fig, 23 ref; Official Gazette of the United States Patent Office, Vol. 951, No 3, p 1105, October 19, 1976.

Descriptors: *Patents, *Flow, *Regulated flow, *River flow, *Flow control, *Energy, *Hydrodynamics, Energy conversion, Energy transfer, Turbines.

The river current motor of this invention is based on the principal premise tha in order to remove kinetic energy from a moving mass of water, without thereby reducing the mass rate of flow, it is necessary to provide immediately downstream of the device, a region into which the mass of teated water is impelled to move, and simultaneously, that the mainstream of water is impelled to move away from this region. In addition the invention employs configurations using accepted hydrodynamics principles, to take fullest possible advantage of the passing river stream, utilizing and recovering not only part of the energy in that portion of the river stream actually intercepted by this river turbine, but also utilizing part of the energy of the mainstream to prepare a favorable downstream region for the discharge of the intercepted portion. The river current motor is made up of a primary nozzle with longitudinal horizontal axis, immersed in the river with axis parallel to the river current direction. The primary nozzle has along its axis and entrance end connected t a throuh-going waterway which leads to a throat and then through a tailpiece to the discharge end. It coaxially supports within the throat an axial-entance turbine wheel to which is connected means for transferring mechanical rotational energy to external utilization means. (Sinha-OEIS)
W77-05660

FRICTION EFFECTS ON SPATIALLY VARIED OPEN CHANNEL FLOWS WITH INCREASING DISCHARGE,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W77-05674

FLOOD PLAIN MANAGEMENT THROUGH ALLOCATION OF LAND USES -- A DYNAMIC PROGRAMMING MODEL,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6F.
W77-05720

POST-IMPOUNDMENT EFFECTS OF REGULATED FLOWS FROM DWORSHAK DAM ON THE BENTHIC INSECT COMMUNITY OF THE CLEARWATER RIVER, IDAHO,
Idaho Univ., Moscow. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W77-05725

FLOOD FREQUENCY--EXPECTED AND UNEXPECTED PROBABILITIES,
Water Resources Div. Reston, Va. Geological Survey.
D. M. Thomas.
Open-file report 76-775, 1976. 7 p, 4 fig, 1 tab, 10 ref.

Descriptors: *Flood frequency, *Frequency analysis, *Frequency curves, *Design flood, Estimating, Probability, Evaluation, Hydrologic data, Flow rates.

Flood-frequency curves may be defined either with or without an 'expeced probability' adustment; and the two curves differ in the way that they attempt to average the time-sampling uncertainties. A curve with no adustment is shown to estimate a median value of both discharge and frequency of occurrence, while an expected probability curve is shown to estimate a mean frequency of flood years. The attributes and constraints of the two types of curves for various uses are discussed. (Woodard-USGS)
W77-05747

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
C. H. Hannum.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 762/As, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Investigations 76-62, November 1976. 70 p, 21 fig, 1 plate, 4 tab, 8 ref.

Descriptors: *Flood forecasting, Peak discharge, *Flood frequency, *Natural flow, *Kentucky, Streams, Analytical techniques, Gaging stations, Equations, Estimating, Graphical methods, Flood recurrence interval.
Identifiers: *Unregulated streams, Ungaged streams, *Estimating equations(Floods).

Flood magnitude and frequency relations applicable to unregulated stream in Kentucky are based on flood data at 117 gaging stations in Kentucky and 14 in adjacent states having 10 or more years of record. Equations that related flood magnitude and frequency to contributing drainage area in 16 geographic areas may be used to estimate magnitude of future floods with recurrence intervals of as much as 100 years on gaged and ungaged streams having drainage areas of 10 to 4,300 square miles. Estimating equations are also presented in graphical form. Additional graphs estimate flood magnitude for selected recurrence intervals along the Cumberland, Kentucky, and Ohio Rivers. (Woodard-USGS)
W77-05752

WATER RESOURCES OF WASHTENAW COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich. Water Resources Div.
For primary bibliographic entry see Field 6D.
W77-05759

USE OF WATER IN ARKANSAS, 1975,
Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 6D.
W77-05761

PREDICTING DISPERSION COEFFICIENT OF STREAMS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.

W77-05803

DISCRETE REPRESENTATION OF STORAGE FOR STOCHASTIC RESERVOIR OPTIMIZATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.; and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
V. Klemes.
Water Resources Research, Vol. 13, No. 1, p 149-158, February 1977. 12 fig, 12 ref.

Descriptors: *Reservoir storage, *Optimization, *Stochastic processes, *Dynamic programming, Constraints, Numerical Analysis, Probability, Economics, Equations, Systems analysis, Mathematical models.
Identifiers: Discretization technique.

In explicit stochastic dynamic programming optimization of storae reservoirs, the 'curse of dimensionality' dictates the adoption of the smallest possible number of discrete states to represent the range of reservoir storage. This pressure makes it imperative to understand clearly the consequences of pushing the limit too far. It is shown that the number of storage states is subject to some absolute constraints and that it must increase linearly with the reservoir storage capacity in order that comparability of results be assured. It is demonstrated, both theoretically and with the aid of a numerical example, that a too coarse discrete storage representation can not only impede accuracy but may completely distort reality in most unexpected ways. Finally, charts are presented giving the numbers of storage states necessary to obtain stationary probabilities of reservoir emptiness and/or fullness with an error e epsilon less or more = to 0.1% for log normal and norma input distributions. (Bell-Cornell).c
W77-05921

MODELS FOR CAPACITY PLANNING OF WATER SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 6A.
W77-05924

ADVANCED METHODOLOGIES FOR DESIGN OF STORM SEWER SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-05927

APPLICATION OF A TRANSIENT FLOW MODEL TO COORDINATE URBAN STORM RUNOFF DATA WITH FLOW IN A RECEIVING RESERVOIR,
Tennessee Univ., Knoxville. Water Resources Research Center.
For primary bibliographic entry see Field 5B.
W77-05931

HARVESTING SURFACE RUNOFF AND EPHEMERAL STREAMFLOW IN ARID ZONES,
National Centre for Arid Zone Studies, Saltillo, (Mexico).
For primary bibliographic entry see Field 3B.
W77-05946

SHOT NOISE MODELS FOR THE GENERATION OF SYNTHETIC STREAMFLOW DATA,
Tel-Aviv Univ. (Israel). Dept. of Statistics.
For primary bibliographic entry see Field 2E.
W77-05955

SEASONAL STREAMFLOW ESTIMATION IN THE HIMALAYAN REGION EMPLOYING METEOROLOGICAL SATELLITE SNOW COVER OBSERVATIONS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2C.
W77-05956

OPERATIONAL ASSESSMENT OF HYDROLOGIC MODELS OF LONG-TERM PERSISTENCE,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-05957

AN HIERARCHICAL GOAL PROGRAMMING APPROACH TO ENVIRONMENTAL-LAND USE MANAGEMENT,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6G.
W77-05979

CONSERVATIONAL WATER PRICING FOR INCREASED WATER SUPPLY BENEFITS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6D.
W77-05993

IMPLICATIONS OF RISING ENERGY COSTS FOR IRRIGATED FARMS IN THE OKLAHOMA PANHANDLE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-05995

EXTENDED PERIOD SIMULATION OF WATER SYSTEMS--PART B,
Systems Control, Inc., Palo Alto, Calif.
H. S. Rao, L. C. Markel, and D. W. Bree, Jr.
Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. HY3, Proceedings Paper No. 12805, p 281-294, March 1977. 10 fig, 4 ref. OWRT C-5214(4212)(2).

Descriptors: *Water distribution(Applied), *Reservoirs, *Simulation analysis, *Water demand, *Computer programs, Pumping, Storage, Networks, Equations, Computer models, Systems analysis, Design.
Identifiers: Field tests, Accuracy.

In Part A of this study, theoretical considerations for an extended period simulation of water distribution networks were presented. The simulation was shown to consist of a sequence of static network solutions linked by an integration scheme for equations describing reservoir dynamics. Static network balances were obtained by exploiting the sparse structure of the network incidence matrix in the iterative scheme for solving nodal equations by a modified Newton-Raphson technique. A computer program called WATSIM (Water System Simulator) was developed to perform the extended period simulation of water networks. This paper describes a validation study to determine the accuracy of the extended period simulation of a water distribution network using the WATSIM program. Experimentation has been done on a portion of the distribution system of San Jose Water Works in California. The WATSIM can be used either for instantaneous solution of a network when reservoir heads and nodal consumptions are specified, or for extended simulations of the network when reservoir characteristics and nodal demand profiles are specified. It is concluded that the experiment demonstrated the effectiveness of the approach within limitations due to data inaccuracies. (Bell-Cornell)
W77-05996

SYNTHESIS OF SNOWMELT RUNOFF HYDROGRAPHS,
Nevada Univ., Reno. Desert Research Inst.; and Nevada Univ., Reno. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W77-06000

MULTISTATION, MULTIYEAR SYNTHESIS OF HYDROLOGIC TIME SERIES BY DISAGGREGATION,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06008

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN ENVIRONMENTAL DISPERSION MODELS,
Cleveland State Univ., Ohio.
For primary bibliographic entry see Field 2A.
W77-06010

TIME RESOLUTION OF THE HYDROLOGIC TIME-SERIES MODELS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-06013

CONNECTICUT RIVER WATER RESOURCE DECISION-MAKING,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W77-06017

THE NEW YORK WILD, SCENIC AND RECREATIONAL RIVERS SYSTEM ACT,
Columbia Univ., New York. School of Law.
For primary bibliographic entry see Field 6E.
W77-06041

THE LAW OF DIFFUSED SURFACE WATER IN EASTERN RIPARIAN STATES,
Connecticut Univ., Storrs. School of Law.
For primary bibliographic entry see Field 6E.
W77-06042

RECENT DEVELOPMENTS IN THE RECOGNITION OF INSTREAM USES IN WESTERN WATER LAW,
Indiana Univ. at Bloomington. School of Law.
For primary bibliographic entry see Field 6E.
W77-06044

PROPOSALS FOR IMPROVING THE MANAGEMENT OF INTERNATIONAL RIVER BASINS,
Cornell Univ., Ithaca, N.Y. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6E.
W77-06051

PROCEEDINGS MISSISSIPPI WATER RESOURCES CONFERENCE 1976.
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
125 p, 58 fig, 9 plate, 3 tab. Conference held in Jackson, Miss. on April 20, 1976. OWRT A-999-MISS(12).

Descriptors: *Water resources, *Conferences, *Water quality, *Water management(Applied), Administrative agencies, Federal government, State governments, *Mississippi, Information exchange, Publications, Hurricanes, Surges, River forecasting, Lakes, Fish, Impoundments, Sedimentation, Reservoirs, Erosion, Forest management, Storm runoff.
Identifiers: *Endangered species.

The Eleventh Mississippi Water Resources Conference, held to exchange information about water resources, presented numerous papers prepared by state and federal agencies. The Corps of Engineers discussed surge effects from Hurricane Eloise. The National Weather Service reported on community self-help river forecasting procedures. A study of water quality in Bay Springs Lake of the Tennessee-Tombigbee Waterway was presented by the Waterways Experiment Station. The Soil Conservation Service discussed the ecology of endangered fish species in Bayon Pierre. Physico-chemical conditons of 14 small Mississippi impoundments from 1973-76 were the subject of a game and fish commission report. Other topics covered include remote sensing in sedimentation research, heat content of North Mississippi reservoirs, erosion measurements from a lister-fill farming system, effects of forest management practices on stormflow sources and water quality, and the cost-output relationship in Mississippi water systems. (See W77-06085 thru W77-06090) (Capehart-Florida)
W77-06084

SURGE EFFECTS FROM HURRICANE ELOISE,
Army Engineer District, Mobile, Ala. Navigation and Coastal Branch.
For primary bibliographic entry see Field 2L.
W77-06085

COMMUNITY SELF-HELP RIVER FORECAST PROCEDURES,
National Weather Service, Atlanta, Ga. Southeast River Forecast Center.
W. E. Fox, and W. L. Hurst.
In: Proceedings of Mississippi Water Resources Conference 1976, p 19-44. 13 fig, 2 tab, 6 ref.

Descriptors: *River forecasting, *Warning systems, *Flood forecasting, *Hydrograph analysis, Floods, Forecasting, Storm runoff, Rainfall disposition, Hydrographs, Evapotranspiration, Rainfall, Flash floods, Flood peak, Distribution patterns, Time lag, Flood stages, Peak discharge, Reliability.

The normal procedures for flood forecasting utilized by the National Weather Service are too slow to provide adequate forecasts for many areas. Two methods have been developed to alleviate this problem. The first is a community self-help river forecasting system in the form of flood warning tables. The self-help system tables require the following: computation of storm runoff; conversion of storm runoff volume into a hydrograph of discharge versus time; approximation of the assumed distribution of rainfall during the storm; and a method for determining the crest stage when the peak discharge forecast is availble. The authors present methods for performing these calculations and explain the use of self-help warning tables. A discussion of forecast accuracy is also included. Another forecasting system discussed is the flash flood warning system. A combination of both systems is recommended as the most effective warning system. (See also W77-06084) (Capehart-Florida)
W77-06086

BAY SPRINGS LAKE WATER QUALITY STUDY,
Army Engineer Waterways Experiment Station, Bicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-06087

HEAT CONTENT OF NORTH MISSISSIPPI RESERVOIRS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W77-06088

EROSION MEASURED FROM A LISTER-TILL SYSTEM,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
For primary bibliographic entry see Field 4D.
W77-06089

4B. Groundwater Management

A DECOMPOSED AQUIFER MODEL SUITABLE FOR MANAGEMENT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-05737

PHYSICAL, CHEMICAL, AND BIOLOGICAL ASPECTS OF SUBSURFACE ORGANIC WASTE INJECTION NEAR WILMINGTON, NORTH CAROLINA,
Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05739

NUMERICAL SIMULATION ANALYSIS OF THE INTERACTION OF LAKES AND GROUND WATER,
Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 2H.
W77-05740

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, ASH MEADOWS, NEVADA, 1975-76,
Water Resources Div. Carson City, Nev. Geological Survey.
For primary bibliographic entry see Field 7C.
W77-05745

ELECTRIC ANALOG SIMULATION OF THE AQUIFERS ALONG THE SOUTH COAST OF PUERTO RICO,
Water Resources Div. Reston, Va. Geological Survey.
For primary bibliographic entry see Field 2F.
W77-05746

MATHEMATICAL MODEL OF THE WEST BOLSA GROUND-WATER BASIN, SAN BENITO COUNTY, CALIFORNIA,
Water Resources Div. Atlanta, Ga. Geological Survey.
For primary bibliographic entry see Field 2F.
W77-05748

LAND-SURFACE SUBSIDENCE AT SEABROOK, TEXAS,
Water Resources Div. Houston, Tex. Geological Survey.
R. K. Gabrysch, and C. W. Bonnet.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 621, Price codes: A06 in paper copy, A01 in microfiche. Water-Resources Investigations 76-31, October 1976. 53 p, 30 fig, 4 tab, 10 ref.

Descriptors: *Land subsidence, *Pumping, *Groundwater, *Oil, *Texas, Compaction, *Withdrawal, Water levels, Wells, Water demand, Water utilization, Water management(Applied), Artesian heads, Pressure, Clays.
Identifiers: Harris County(Tex), Galveston County(Tex), *Seabrook(Tex).

Removal of water, oil, and gas from the subsurface in Harris and Galveston Counties, Texas, has caused a decline in fluid pressures, which is turn had resulted in subsidence of the land surface. Subsidence of the land surface at Seabrook is due principally to the removal of water. Significnt subsidence of the land surface probably began after 1920, and a minimum of about 3.3 feet and a maximum of about 4.3 feet of subsidence had occurred at Seabrook by 1973. Probable future subsidence was calculated by two different methods for each of two different loading situations. In the first loading situation, the artesian heads in the Alta Loma Sand (Rose, 1943) and Evangeline aquifer would continue to decline at the respective rates of 8 feet per year and 7 feet per year until 1980 and then cease. In the second loading situation, the artesian heads in the Alta Loma Sand and Evangeline aquifer would continue to decline at rates of 8 and 7 feet per year ulntil 1990 and then cease. (Woodard-USGS)
W77-05749

LAND-SURFACE SUBSIDENCE IN THE AREA OF MOSES LAKE NEAR TEXAS CITY, TEXAS,
Geological Survey, Houston, Tex. Water Resources Div.
R. K. Gabrysch, and C. W. Bonnet.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 620, Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 76-32, October 1976. 42 p, 21 fig, 4 tab, 25 ref.

Descriptors: *Land subsidence, *Pumping, *Groundwater, *Oil, *Texas, *Withdrawal, *Drawdown, Compaction, Water levels, Wells, Water demand, Water utilization, Water management(Applied), Artesian heads, Pressure, Clays.
Identifiers: Harris County(Tex), Galveston County(Tex), *Moses Lake area(Tex).

Removal of water, oil, and gas from the subsurface in Harris and Galveston Counties has caused declines in fluid pressures, which in turn have resulted in subsidence of the land surface. Subsidence of the land surface at Moses Lake in due principaly to the removal of ground water in adjacent areas. Significant subsidence of the land surface at Moses Lake began after 1900, and as much as 1.8 feet of subsidence had occurred in the ara by 1973. Probably future subsidence was calculated by two methods for two loading situations. In the first loading situation, the artesian head in the middle Chicot aquifer, in the Alta Loma Sand (Rose, 1943), and in the Evangeline aquifer would continue to decline at respective rates of 1, 3, and 3 feet per year until 1980 and then cease. In the second loading situation, the artesian head in the middle Chicot aquifer, in the Alta Loma Sand, and in the Evangeline aquifer would continue to decline at respective rates of 1, 3, and 3 feet per year until 1990 and then cease. (Woodard-USGS)
W77-05750

GEOLOGIC EVALUATION OF WASTE-STORAGE POTENTIAL IN SELECTED SEGMENTS OF THE MESOZOIC AQUIFER SYSTEM BELOW THE ZONE OF FRESH WATER, ATLANTIC COASTAL PLAIN, NORTH CAROLINA THROUGH NEW JERSEY,
Geological Survey, Raleigh, N.C. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05753

PREDICTED EFFECTS OF A PROPOSED WATER-RESOURCE MANAGEMENT PLAN IN THELOWER SAN LUIS REY RIVER VALLEY, CALIFORNIA, USING DIGITAL GROUND-WATER FLOW MODELS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
J. A. Skrivan.
Open-File report 76-754, October 1976. 19 p, 10 fig, 4 tab, 2 ref.

Descriptors: *Watershed management, *Groundwater resources, *Groundwater move-

ment, *Salt balance, *Model studies, Evaluation, Water level fluctuations, Pumping, Groundwater recharge, Planning, Computer models, *California.
Identifiers: *Lower San Luis Rey River Valley(Calif).

A proposed plan for water-resource management in the lower San Luis Rey River valley, Calif. has been evaluated using digital models of groundwater flow. Two projections of water-level changes and salt balance in 1977 were made. The first projection used 1972 climatic and pumping conditions. The second projection used these same conditions plus a plan of recharging and pumping various areas of the aquifer. The predicted salt balance in 1977 under the proposed plan improved for the Pala, Bonsall, and Mission basins when compared to the predicted 1977 salt balance using 1972 pumpage alone. The plan did not affect the predicted salt balance for the Pauma basin. Under the plan, water levels decreased in the Pala basin and water levels increased in the Bonsall and Mission basins. In addition, an area of potential water logging exists in the Mission basin. The plan did not affect water levels for the Pauma basin. (Woodard-USGS)
W77-05755

CHEMICAL QUALITY OF GROUND WATER IN THE TEHAMA-COLUSA CANAL SERVICE AREA, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5A.
W77-05756

GROUND WATER IN THE HARRISBURG-HALSEY AREA, SOUTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
F. J. Frank.
Available from the Superintendent of Documents, GPO, Washington, D.C. 20402, price $1.05. Water-Supply Paper 2040, 1976. 45 p, 7 fig, 1 plate, 9 tab, 18 ref.

Descriptors: *Groundwater resources, *Water utilization, *Water quality, *Hydrologic data, *Oregon, Aquifer characteristics, Available water, Water wells, Withdrawal, Water level fluctuations, Water yield, Groundwater recharge, Drillers logs, Hdrogeology.
Identifiers: *Southern Willamette Valley (Oreg).c

The Harrisburg-Halsey area lies between the Cascade and Coast Ranges in the southern Willamette Valley. The area consists of approximately 350 square miles and includes a part of the foothills of the Coast and Cascade Ranges. Volcanic and marine edimentary units exposed in the foothills yield only small quantities of water. The alluvial deposits (sand and gravel) of the valley plain contain the most productive aquifers. Aquifers in the area are recharged principally by direct infiltration of precipitation. In the valley plain the annual recharge by infiltration of precipitation is about 170,000 acre-feet. The Volume of ground water pumped for all uses in 1974 was about 14,300 acre-feet. Ground water from the alluvial deposits is chemically suitable for irrigation and other uses, as is most of the water in the older sedimentary and volcanic rocks. Locally, water from deeper zones in the older sedimentary rocks beneath the valley plain is too mineralized for most uses. (Woodard-USGS)
W77-05757

WATER RESOURCES OF WASHTENAW COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich. Water Resources Div.
For primary bibliographic entry see Field 6D.
W77-05759

USE OF WATER IN ARKANSAS, 1975,
Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 6D.
W77-05761

ON RADIOACTIVE WASTE MANAGEMENT: MODEL ANALYSIS OF A PROPOSED SITE,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 5E.
W77-05791

PERMEATION PROPERTIES OF THE BUNTER SANDSTONE OF NORTHWEST LANCASHIRE, ENGLAND,
Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
For primary bibliographic entry see Field 2F.
W77-05793

NUMERICAL PUMPING TEST ANALYSIS IN UNCONFINED AQUIFERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-05805

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
D. Bannert.
Type III Report, SR No. 330, November 1974. 13 p, 7 fig, 2 ref.

Descriptors: *Remote sensing, *Hydrogeology, *Groundwater, *South America, Satellites(Artificial), Soil water, Land use, Foreign countries, Water quality, Salinity, Foreign research, Salts, Vegetation, Data processing, Analytical techniques, Hydrology.
Identifiers: *ERTS, *Argentina(Pampa).

Increasing demand for potable groundwater, in addition to stock watering, led to a larger-scale hydrogeological investigation of about 50,000 sq kms of the Argentine Pampa. The area is situated between the Sierra de Cordoba in the West and the Rio Parana in the East. A team of hydrogeologists and technicians from the Federal Geological Survey of Germany conducted hydrogeological investigations in cooperation with Argentinian Organizations during the years 1969-1973. The multispectral investigation of ERT-1 imagery had added detailed knowledge to the results of groundwater investigations achieved by conventional ground survey in the Argentine Pampa. A number of natural features and units of the earth's surface have been identified and delineated on the imagery. These features are closely related to conditions in the near surface groundwater bodies. Satellite imagery in combination with ground investigations allows the identification and delineation of difference in the conditions of the near surface groundwater (depth to groundwater, salinity). The degree of precision achieved is greater than that obtainable by conventional ground survey methods alone. (Sims-ISWS)
W77-05813

HYDROGEOLOGY OF THE FOREMOST AREA, ALBERTA,
Research Council of Alberta, Edmonton.
D. M. Borneuf.
Report 74-4, 1976. 30 p, 1 fig, 1 map, 4 tab, 27 ref, 2 append.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Groundwater, *Canada, Topography, Maps, Drainage, Climatology, Precipitation(Atmospheric), Geology, Geologic formations, Bedrock, Wells, Water wells, Aquifers, Dissolved solids, Water chemistry, Nitrates, Chlorides, Sodium compounds, Water quality, Water yield, Water resources.
Identifiers: *Foremost area(Alberta), *Alberta(Canada).

In the western half of the map area, sandstone of the lower member of the Milk River Formation (hereafter referred to as the lower Milk River sandstone) is the main aquifer; in the eastern half, permeable lenses in the drift are the main sources of groundwater. Yields range from 5 to 500 igpm (0.38 to 38 1/s) in the lower Milk River sandstone, and they range from 5 to 100 igpm (0.38 to 7.6 1/s) in the drift. Higher yields are more common in the lower Milk River sandstones than in the drift. Total dissolved solids are usually over 1,000 ppm in waters from both aquifers. The Milk River sandstone waters are mostly sodium bicarbonate type, with a northern area of sodium carbonate (corresponding to a change in lithology and depth) as well as sodium bicarbonate and chloride waters. Nitrates do not seem to be significant in either of these two areas. Fluorides are generally high in the Milk River sandstone waters. A large hydrogeological map was included in a cover pocket. (Sims-ISWS)
W77-05817

HYDROGEOLOGY OF THE VERMILION AREA, ALBERTA,
Research Council of Alberta, Edmonton.
D. V. Currie, and N. Zacharko.
Report 75-5, 1976. 15 p, 3 fig, 1 map, 1 tab, 18 ref.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Groundwater, *Canada, Topography, Drainage, *Maps, Climatology, Precipitation(Atmospheric), Geology, Geologic formations, Wells, Water wells, Groundwater movement, Aquifer, Water levels, Water yield, Water chemistry, Dissolved solids, Sulfates, Sediments, Water resources.
Identifiers: *Vermilion area(Alberta), *Alberta(Canada).

The Vermilion map area lies in the plains-parkland transition zone of east-central Alberta and covers approximately 5660 sq mi (14,660 sq km). Average annual precipitation is 16 in (41 cm), and potential evaporation exceeds precipitation from April to October. Both bedrock and surficial deposits are possible groundwater sources. The bedrock interval supplying groundwater in the region is a complex interfingering of sandstones and shales in the lower Belly River Formation. There is difficulty in correlating the various sandstones over even small distances, but two units, the Ribstone Creek and the Birch Lake members, are fairly widespread and form the major aquifers in the region with yields of 25-100 igpm (100-450 1/min). Sediments in preglacial and melt water channels are a secondary source of groundwater and yield 5-25 igpm (25-100 1/min) or more, depending on aquifer lithology. Groundwater quality is generally good, with total dissolved solids within the limits of human consumption; although in regions of discharge, total dissolved solids and sulfate values can be very high. In addition to the groundwater availability map at 1:250,000 scale, the related maps at 1:1,000,000 and the hydrogeological sections, three detailed geological sections of the northeast portion of the map area, were included. (Sims-ISWS)
W77-05818

HYDROGEOLOGY OF THE EDMONTON AREA (NORTHEAST SEGMENT), ALBERTA,
Research Council of Alberta, Edmonton.
R. Stein.
Report 76-1, 1976. 21 p, 2 map, 25 ref.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Groundwater, *Canada, Topography, Drainage, *Maps, Climatology, Precipitation(Atmospheric), Geology, Geologic formations,

Wells, Water wells, Groundwater movement, Aquifers, Water levels, Water yield, Water chemistry, Dissolved solids, Nitrates, Chlorides, Sulfates, Water resources.
Identifiers: *Edmonton Area(Alberta), *Alberta(Canada).

The northeast segment of the Edmonton map area (NTS 83H) covers about 1750 sq mi (4500 sq km) within the Eastern Alberta Plains physiographic region. It has a microthermal climate, with long, cool summers, and receives an average of 17 in (430 mm) of precipitation annually, 70% as rain. Glacial and postglacial deposits overlie a succession of Upper Cretaceous shales, siltstones, sandstones, and coals. Within these deposits, aquifers consisting of sand, sand and gravel, sandstone, and fractured coal and shale are capable of yielding groundwater at rates of up to 100 igpm (7.6 l/s). Natural groundwater movement is of a complex nature, showing effects of both topography and permeability variations. Hydrochemistry is highly variable, especially in surficial aquifers, but groundwater is generally of the sodium bicarbonate type, with total dissolved solids between 1000 and 2000 ppm. More highly mineralized groundwater occurs locally (total dissolved solids of up to 6000 ppm) and is either of the chloride or sulfate type. Many shallow wells completed in drift aquifers contain substantial amounts of nitrates. Two hydrological maps were included in a cover pocket. (Sims-ISWS)
W77-05819

HYDROGEOLOGY OF THE TRI-CREEK BASIN, ALBERTA,
Research Council of Alberta, Edmonton.
D. V. Currie.
Bulletin 33, 1976. 67 p, 42 fig, 19 plate, 11 tab, 32 ref, 6 append.

Descriptors: *Hydrogeology, *Areal hydrogeology, *Groundwater, *Canada, Watersheds(Basins), Forested watersheds, Forests, Geology, Geologic formations, Precipitation(Atmospheric), Drainage, Streamflow, Streams, Rivers, Vegetation, Vegetation effects, Water levels, Water yield, Wells, Water wells, Water chemistry, Erosion, Water resources.
Identifiers: *Tri-creek Basin(Alberta), *Alberta(Canada).

Groundwater flow in Tri-creek basin, a 23 sq mi (60 q km) area of the Rocky Mountain Foothills in western Alberta, is controlled by the surficial and bedrock geology. Flow in the bedrock follws bedding planes and joints; flow in surficial deposits is governed by relative permeability. Flow systems are short, shallow, and raplid; the depth of active groundwater flow is probably less than 300 ft (less than 91 m), and metamorphosis of groundwater is limited by the short residence time below the surface. Response to changes in precipitation is generally rapid, although slower responses were noted at some points in the region. Observed groundwater discharge feature include: springs of several kinds, seepages, hummocky ground, swamps, and amphitheater-shaped depressions. Quantitative drainage pattern data included a bifurcation ratio of 5.6 (indicative of strong geologic control) in one of the three subbasins, and values of less than 5 (little geologic control) in the other two. Average drainage density is 4.1. Relief ratios of 0.04 to 0.06 indicate glacial derangement of drainage. Depth to water table, estimated from studies of the various phreatophytic plant assemblages, ranges from 1 to 8 ft (0.3 to 2.4 m). Allowable rate of well pumping vary from 0.5 to approximately 100 imperial gallons per minute (igpm), or 2 to 450 litres per minute (l/min); but values greater than 25 igpm (115 l/min) are associated with scatered deposits of ice-contact drift and are not typical of the area. Wells yield 5-10 ipgm (25 to 45 l/min) on the average. (Sims-ISWS)
W77-05820

TRICHLOROFLUOROMETHANE IN GROUND WATER - A POSSIBLE INDICATOR OF GROUND-WATER AGE,
Purdue Univ., Lafayette, Ind. Water Resource Research Center.
For primary bibliographic entry see Field 2F.
W77-05851

THE SIMULATION OF WHOLE CORE PERMEAMETER FLOW GEOMETRY,
Louisiana State Univ., Baton Rouge. Dept. of Petroleum Engineering.
For primary bibliographic entry see Field 2F.
W77-05933

THERMAL CONVECTION IN A CAVERNOUS AQUIFER,
Florida Univ., Gainesville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-05951

SALT WATER PUMPING CONTROLS SEA WATER INTRUSION,
Ground Water Consultants Group, Edmonton (Alberta).
For primary bibliographic entry see Field 2L.
W77-05972

THE RESPONSE EQUATION METHOD: A NEW ROLE FOR SIMULATION OF ENVIRONMENTAL SYSTEMS,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-05978

TRACING SEWAGE EFFLUENT RECHARGE--TUCSON, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources; and Arizona Univ., Tucson. Coll. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W77-05999

DUPUIT-FORCHHEIMER AND POTENTIAL THEORIES FOR RECHARGE FROM BASINS,
California State Univ., Fullerton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-06004

FOREST VEGETATION CONDITIONS OF THE SAND TRACT OF TOSYNKUMY (KAZAKH SSR), (IN RUSSIAN),
For primary bibliographic entry see Field 2I.
W77-06031

THE LAW OF DIFFUSED SURFACE WATER IN EASTERN RIPARIAN STATES,
Connecticut Univ., Storrs. School of Law.
For primary bibliographic entry see Field 6E.
W77-06042

GROUND WATER PROBLEMS WITH OIL SHALE MINING IN THE PICEANCE BASIN,
Geological Survey, Denver, Colo. Water Resources Div.
J. B. Weeks.
Water Spectrum, Vol 8, No 1, p 8-14 (Spring-Summer 1976). 3 fig, 1 map, 5 photo.

Descriptors: *Oil shales, *Mining, *Groundwater basins, *Groundwater availability, Water quality, Oil industry, Subsurface waters, Feasibility, Data collections, Water resources, Water pollution, Aquifers, Computer models, Water treatment, Water demand, Dewatering, Energy, Environmental effects, Colorado, Wyoming, Utah.
Identifiers: *Piceance Basin(Colo), Green River Formation.

Large deposits of oil shale lie buried within the geologic strata of the Green River Formation. The problem is to find a way to reach this subterranean resource and convert it for the country's use without excessively degrading the region's water resources. Four tracts of public lands have been leased to private industry to determine the economic feasibility of producing oil from oil shale. Two of the tracts are located in Piceance Basin in Colorado. The lessees will use ground water produced from dewatering the oil shale mines in order to supply the water necessary to process the oil shale and dispose of the spent shale. A computer model of the ground-water flow system has been developed to evaluate the effects of mine dewatering on the ground water system. Results indicate that tract C-a will not be able to meet the annual water demand after the first few years of dewatering. Tract C-b will have a problem of water disposal and the quality of the water pumped from the oil shale mines will deteriorate as dewaering continues into the future. Several alternative solutions are being considered. (Martine-Florida)
W77-06045

4C. Effects On Water Of Man's Non-Water Activities

THE ENVIRONMENT OF SOUTH FLORIDA, A SUMMARY REPORT,
Geological Survey, Miami, Fla. Water Resources Div.
For primary bibliographic entry see Field 6G.
W77-05738

EROSIONAL LANDFORM MAP OF THE REDWOOD CREEK DRAINAGE BASIN, HUMBOLDT COUNTY, CALIFORNIA, 1947-74,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05742

BASIC DATA ON URBAN STORM-WATER QUALITY, PORTLAND, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05744

AN APPLICATION OF THE UTAH STATE UNIVERSITY WATERSHED SIMULATION MODEL TO THE ENTIAT EXPERIMENTAL WATERSHED, WASHINGTON STATE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W77-05918

ENVIRONMENTAL IMPACTS OF LAND USE CHANGE,
Hawaii State Dept. of Planning and Economic Development, Honolulu. Research and Economic Analysis Div.
For primary bibliographic entry see Field 6G.
W77-05922

THE EFFECTS OF COARSE GRANITIC SEDIMENT ON THE DISTRIBUTION AND ABUNDANCE OF SALMONIDS IN THE CENTRAL IDAHO BATHOLITH,
Idaho Univ., Moscow.
R. R. Klamt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 202, Price codes: A05 in paper copy, A01 in microfiche.

M.S. Thesis, Fisheries Resources, July 1976. 85 p, 34 fig, 12 tab, 28 ref, append. OWRT B-036-IDA(1), 14-31-0001-5069.

Descriptors: *Sediment transport, Sedimentation, *Salmonids, Chinook salmon, Cutthroat trout, Aquatic insects, Diptera, Idaho, Rainbow trout, *Distribution, *Growth rates.
Identifiers: *Insect drift density, *Central Idaho batholith, Knapp Creek(Idaho).

The effects of coarse granitic sediment on the abundance, distribution and growth and behavior of juvenile salmonids and the abundance of aquatic insect drift were assessed by adding sediment to artificial and natural stream channels. These data were compared to two natural streams in the central Idaho batholith which already contained large amounts of sediment by correlating fish and insect drift abundance with percentage riffle sediment, riffle size, percentage cover in the pools, and average pool substrate imbeddedness. Densities of juvenile steelhead trout, chinook salmon and cutthroat trout in the artificial stream channels decreased as the amount of sediment increased in the channels. The densities of fish remaining in the channels during the winter tests were smaller than in the summer tests. Total insect drift density was not affected by the addition of sediment to the riffles in the artificial streams, but evidence of a community shift to Diptera was observed. Addition of sediment into Knapp Creek reduced fish densities due to loss of cover and pool volume. Insect benthos and drift abundance was not significantly changed. Fish density correlated best with cover and insect drift density in the natural streams studied. Sediment altered the amount and quality of cover in the pools studied. Insect drift density correlated best with riffle size, and to a lesser degree with percentage sediment in the riffles.
W77-05932

GRAZING SYSTEMS AND WATERSHED MANAGEMENT: A LOOK AT THE RECORD,
Utah State Univ., Logan. Coll. of Natural Resources.; and Utah State Univ., Logan. Watershed Science Unit.
For primary bibliographic entry see Field 4D.
W77-05936

GRAZING AND DEBRIS BURNING ON PINYON-JUNIPER SITES--SOME CHEMICAL WATER QUALITY IMPLICATIONS,
Oregon State Univ., Corvallis. Rangeland Resource Program.
For primary bibliographic entry see Field 5B.
W77-05991

4D. Watershed Protection

EFFECTS OF ANTECEDENT SOIL MOISTURE ON STORM HYDROGRAPHS,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2A.
W77-05603

A STUDY OF RUNOFF FROM SMALL RURAL WATERSHEDS IN RESPONSE TO COMPLETED AND PROPOSED LAND USE CHANGES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05728

A STOCHASTIC APPROACH TO SPACE-TIME MODELING OF RAINFALL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2A.
W77-05730

EVALUATION OF AGRICULTURAL ADJUSTMENT TO IRRIGATION WATER SALINITY: A CASE STUDY FOR PINAL COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 3C.
W77-05733

THE WATER QUALITY OF STREAMFLOW FROM PONDEROSA PINE FORESTS ON SEDIMENTARY SOILS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 5B.
W77-05734

COMPUTER SIMULATION OF SNOWMELT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2C.
W77-05735

A DESCRIPTIVE CATALOGUE OF THE AUSTRALIAN REPRESENTATIVE BASINS 1975.
Department of National Resources, Canberra (Australia).
Australian Government Publishing Service, Canberra, 1975. 257 p, 81 map, 122 ref. Compiled by F. J. Milne.

Descriptors: *Basins, *Watersheds(Basins), *Australia, *Maps, *Mapping, Aerial photography, Rivers, Drainage, Environment, Climates, Climatology, Evaporation, Precipitation(Atmospheric), Runoff, Streamflow, Geology, Geomorphology, Vegetation, Soils, Land use, Topography, Drainage districts, Drainage systems.

The purpose of this catalogue was to record basic information on the representative basins in Australia and to stimulate interest in the basins as suitable sites for a wide range of environmental studies, with the view to maximizing the effectiveness of the hydrological program and minimizing superfluous environmental research and investigation effort. The catalogue described the characteristics of representative basins which have already been selected, and it described the few regions where basins have yet to be selected. It listed the basic data collection stations, showed their location on topographic maps, and indicated the periods of records available. It also listed available maps, aerial photographs, and details of other field work. The information contained in the catalogue will be progressively updated, and a second edition is expected to be issued in several years time when all basins at present planned will have been selected and instrumented. (Sims-ISWS)
W77-05816

AN APPLICATION OF THE UTAH STATE UNIVERSITY WATERSHED SIMULATION MODEL TO THE ENTIAT EXPERIMENTAL WATERSHED, WASHINGTON STATE,
Utah Water Research Lab., Logan.
D. S. Bowles, J. P. Riley, and G. B. Shih.
Report PRWG126-1, Utah Water Research Laboratory, October 1975. 50 p, 22 fig, 6 tab, 32 ref, append. (Prepared for Forest Service, U.S. Department of Agriculture, Portland, Oregon).

Descriptors: *Small watersheds, *Forest fires, *Effects, *Runoff, *Simulation analysis, *Computer models, *Hydrologic models, *Washington, Drainage area, Streamflow, Forest management, Watershed management, Water yield, Mountain forests, Precipitation, Mathematical models, Equations, Systems analysis.

To study the effects of a forest fire on runoff characteristics, the Utah State University Watershed Simulation Model (USUWSM) has been applied to three small drainage areas in the Entiat Experimental Watershed which is located within the Wenatchee National Forest of central Washington. Each component of the USUWSM has been described in this report, including structural changes to the model that were necessary to achieve reasonable agreement between observed and simulated runoff hydrographs. Lack of information on the spatial distribution of precipitation due to the absence of an adequate precipitation gaging network on or close to the study area was a severe handicap to the simulation study. Only a very short period of post-fire streamflow record was available and thus it was possible to make only qualitative conclusions regarding the effects of the forest fire on runoff characteristics. The study has demonstrated the potential utility of simulation for investigating the physical processes behind changes in runoff characteristics resulting from the effects of fire and other possible management changes on a forest watershed. (Bell-Cornell)
W77-05918

GRAZING SYSTEMS AND WATERSHED MANAGEMENT: A LOOK AT THE RECORD,
Utah State Univ., Logan. Coll. of Natural Resources.; and Utah State Univ., Logan. Watershed-Science Unit.
G. F. Gifford, and R. H. Hawkins.
Journal of Soil and Water Conservation, Vol. 31, No. 6, p. 281-283, Nov.-Dec. 1976. 2 tab, 9 ref.

Descriptors: *Grazing, *Watershed management, *Range management, *Cover crops, Litter, Revegetation, Grasses, Shrubs, Grasslands, Pastures, Pasture management, Range grasses, Ranges, California.
Identifiers: Basal cover.

Published reports indicate no grazing system consistently or significantly increases plant and litter cover on watersheds. Grazing systems appear to be species specific in that an increased density of one plant species may be accompanied by a decreased density of another; thus, there may be no improvement in watershed protective cover. Season-long grazing was compared with a five-year rest-rotation system (full use, full rest, early-season rest with late-season use, full rest, and early-season use with late-season rest) in California's Lassen National Forest. Results indicated rotation grazing increased litter cover, water absorption (infiltration) and basal cover of desirable plants while reducing bare soil and soil compaction. However, there was no significant difference in the total basal cover of all plants. Other studies comparing systems such as continuous, deferred, and deferred-rotation grazing are discussed, including those used on semi-arid rangeland. There is essentially no information on the impact of rest-rotation systems on watershed cover, despite the fact that such systems are being advocated for much western rangeland. (Jahns-Arizona).
W77-05936

SURFACE RUNOFF WASHING OF CLAY TAKYRS IN RIDGES WITH HOLES, (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR. Nebit-Dag. Nebit-Dag Agroformelioration Research Station.
For primary bibliographic entry see Field 2G.
W77-05938

HYDROLOGY FOR SOIL AND WATER CONSERVATION IN THE COASTAL REGIONS OF NORTH AFRICA--EXAMPLE OF A HYDROLOGICAL TECHNIQUE FOR SMALL BASINS,
Soil Conservation Service, Washington, D.C. Engineering Div.
For primary bibliographic entry see Field 3B.
W77-05945

MANAGEMENT AND REGENERATION OF DEGRADED CATCHMENTS AND ERODED PASTORAL LANDS WITH PARTICULAR REFERENCE TO RANGE RESEEDING,
Western Australia Dept. of Agriculture, South Perth.
K. Fitzgerald.
In: FAO Conservation Guide 3, Conservation in Arid and Semiarid Zones, Rome, Italy, 1976. p 41-60 17 fig, 7 ref.

Descriptors: *Erosion control, *Pasture management, *Watershed management, *Erosion rates, *Range management, Erosion, Pastures, Ranges, Vegetation effects, Soil types, Degradation(Slope), Runoff, Rainfall-runoff relationships, Silting, Erosion control, Grazing, Arid lands, *Australia.
Identifiers: Gascoyne River basin(W Australia), Ord River basin(W Australia).

The basic cause of erosion and reduced productivity of many formerly productive agricultural and pastoral lands is the removal of vegetative cover by consistent and continuous overgrazing by both domestic stock and wild animals under marginal rainfall conditions. This phenomenon is discussed in detail as it affects Western Australia. Background information on which range management decisions can be made is presented. Two major catchment areas in Western Australia, the Gascoyne River and the Ord River, both subject to long periods of excessive grazing, have been undergoing remedial treatment and illustrate two different approaches to the management and regeneration of degraded catchments. Both of these areas are described and discussed in detail. The conclusion is reached that good range management should aim at preserving native perennial vegetation in an optimum condition to maintain productivity, promote maximum water penetration, reduce erosion, and avoid the need for expensive and often inadequate remedial treatment. For management to be really effective the fullest cooperation is required between government agencies and pastoral lessees. (Jamail-Arizona)
W77-05947

RESTORATION AND PROTECTION OF DEGRADED SLOPES,
Food and Agriculture Organization of the United Nations, Kabul (Afghanistan).
L. Bostanoglu.
In: FAO Conservation Guide 3, Conservation in Arid and Semiarid Zones, Rome, Italy, 1976. p 105-125. 2 tab, 16 fig, 12 ref.

Descriptors: *Slope protection, *Watershed management, *Terracing, *Vegetation establishment, *Soil erosion, Erosion, Slopes, Slope stabilization, Arid lands, Flash floods, Watersheds(Divides), Erosion control, Conservation, Enbankments, Soil conservation.

The problem of erosion of mountain watersheds, particularly in arid regions, is discussed and several possible methods for its control evaluated. Vegetation establishment is one of these methods. It involves consideration of species that are not only useful for soil conservation purposes alone, but also for production of wood and fiber, for wildlife habitat, or for social benefits. Other erosion control methods using vegetation are the encouragement of natural vegetation, branch layering, sodding, and reforestation of rocky slopes. Consolidation of unstable slopes is discussed, including crumbling slopes, subsiding slopes, and sliding ground. Contour ploughing on eroded lands helps reduce runoff. Terracing, an erosion control method presented in detail, is expensive, time consuming and best considered as a temporary measure to aid the initial establishment of vegetation. (Jamail-Arizona)
W77-05948

FLOOD EFFECTS ON STREAM ECOSYSTEMS,
Soil Conservation Service, Little Rock, Ark.
R. A. Grizzell.
Journal of Soil and Water Conservation, Vol. 31, No. 6, p 283-285, Nov.-Dec. 1976. 1 tab, 23 ref.

Descriptors: *Flood damage, *Sedimentation, *Silting, *Streams, *Ecosystems, Streamflow, Sediment load, Water pollution, Fish, Invertebrates, Aquatic plants, Scour.

As excess water runs off a watershed and passes into a stream system, the water velocity of that stream increases and sediment begins to move along with heavier materials that may be dislodged. Attached to or beneath sand or gravel particles is a complex life of algae, other plants, and animals such as larvae, crayfish and fish eggs. Increased sediment load from flooded roads, agricultural land, geological weathering, construction sites, and streambank erosion has a major impact. Sediment reduces the aesthetic quality of streams, fills up pool areas, restricts flow, covers valuable cropland, and carries pollutants. In addition, there is a decrease of photosynthesis, oxygen in the water, and survival rates of invertebrates and fish eggs. Sediment inhibits the growth of valuable waterfowl food plants and, together with silt, damages gravel- and rubble-type stream bottoms. Silt and other suspensoids affect fisheries by covering the bottom of streams with a blanket of material that kills fauna, reduces available food, and covers nest and spawning grounds. Details are given of the impacts on plants, invertebrates, and fishes. Other animals may be at least temporarily dislocated and possibly destroyed. Soil and water conservation measures to minimize flood danger are outlined. (Jahns-Arizona)
W77-05949

RAINFALL INFILTRATION CHARACTERISTICS FOR A SEMI-ARID WATERSHED SOIL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2G.
W77-05988

MULTIOBJECTIVE PROGRAMING IN WATERSHED MANAGEMENT: A STUDY OF THE CHARLESTON WATERSHED,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
A. Goicoechea, L. Duckstein, and M. M. Fogel.
Water Resources Research, Vol. 12, No. 6, p 1085-1092, December 1976. 1 fig, 2 tab, 29 ref. OWRT B-032-ARIZ(16a) and B043-ARIZ(4).

Descriptors: *Water resources development, *Watersheds(Basins), Management, *Decision making, *Methodology, Economics, Optimization, Land management, *Arizona, Runoff, Wildlife, Recreation, Algorithms, Equations, Mathematical models, Systems analysis, *Watershed management.
Identifiers: *Multiobjective programming, *Nonlinear programming, *Benefit maximization, *San Pedro River basin(Ariz), Cutting plane method.

A multiple-objective approach to decision making in watershed management is developed and demonstrated within the framework of nonlinear programming by means of the case study of the Charleston watershed in southern Arizona. The effects of various land treatments and management practices on water runoff, sediment, recreation, wildlife levels, and commercial potential of a study area are investigated, with constraints on the available land and capital being observed. This leads to a model with five obective functions to be maximized (benefit maximization) under 18 constraints. In an iterative manner, the decision maker proceeds from one noninferior solution to another, comparing sets of land management activities for reaching specified goals and evaluating tradeoffs between individual objective functions. This technique, labeled Trade, involves the formulation of a surrogate objective function and the use of the cutting plane method to solve the general nonlinear problem; it hopefully provides a compromise between computationally intractable and excessively simplified approaches to truly multiobjective water management. (Bell-Cornell)
W77-05994

PROPOSALS FOR IMPROVING THE MANAGEMENT OF INTERNATIONAL RIVER BASINS,
Cornell Univ., Ithaca, N.Y. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6E.
W77-06051

PROCEEDINGS MISSISSIPPI WATER RESOURCES CONFERENCE 1976.
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W77-06084

EROSION MEASURED FROM A LISTER-TILL SYSTEM,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
J. D. Greer, K. C. McGregor, G. E. Gurley, and B. R. Arnold.
In: Proceedings of Mississipi Water Resources Conference 1976, p 103-10. 1 fig, 2 tab, 5 ref.

Descriptors: *Erosion control, *Farm management, *Cultivation, *Demonstration watersheds, Erosion, *Mississippi, Wheat, Soybeans, Rain, Storms, Runoff, Research and development, Crop production, Erosion rates, Contour farming, Soil conservation, Planting management, Soil erosion, Agricultural watersheds, Agricultural engineering, Slopes, Slope protection.
Identifiers: *Lister-till.

The use of conventional farming methods on the sloping lands of north Mississippi has caused severe erosion problems. Experiments have been conducted to evaluate alternative methods for soil conservation purposes. The authors present the results of experiments using the lister-till, or minimum-till, method. The lister-till system combines the middle buster and planting units so that only one operation is required to plant a crop. The experimental plots had slopes of 2.5, 5 and 10%. Both single and double cropping systems were tried. After an analysis of the results of the study, the authors conclude that contoured lister-till should not be recommended for a slope steeper than 5% for either single or double cropping. Tables showing the results are included. (See also W77-06084) (Capehart-Florida)
W77-06089

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

FATE OF 2,4,5-T CONTAMINANT, 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN AQUATIC ENVIRONMENTS,
Wisconsin Univ., Madison. Dept. of Entomology.
For primary bibliographic entry see Field 5B.
W77-05602

STUDIES ON THE ALGAL POPULATIONS OF THE SAALE RIVER NEAR JENA: II. COMPARISON OF THE SEASONAL POPULATION DYNAMICS ABOVE AND BELOW THE CITY, (IN GERMAN),
Jena Univ. (East Germany). Biology Section.
For primary bibliographic entry see Field 5C.

W77-05606

ACUTE TOXICITY OF CADMIUM AND ZINC TO SEVEN INVERTEBRATE SPECIES FROM WESTERN PORT, VICTORIA,
Victoria Ministry for Conservation, Melbourne (Australia). Fisheries and Wildlife Div.
For primary bibliographic entry see Field 5C.
W77-05614

ISOLATION AND IDENTIFICATION OF POLYCHLORINATED STYRENES IN GREAT LAKES FISH,
National Water Quality Lab., Duluth, Minn.
D. W. Kuehl, H. L. Kopperman, G. D. Veith, and G. E. Glass.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 2, p. 127-132, August 1976. 2 fig., 3 tab., 9 ref.

Descriptors: *Lake Ontario, *Lake Huron, *Pollutant identification, Pollutants, *Absorption, *Pesticide residues, *Chemical analysis, Analytical techniques, Mass spectrometry, Gas chromatography.
Identifiers: *Polychlorinated styrenes.

Octachlorostyrene was prepared and gas chromatography retention time data and a mass spectrum of the standard were obtained. A comparison of these data with those observed for fish from Lake Huron, Lake Ontario, and the lower Detroit River indicates that octachlorostyrene is present in fish residues from these sources. In addition, mass spectral data indicated the presence of several hepta and hexachlorostyrene isomers in these fish. Further studies should be concerned with quantification of OCS and evaluation of possible sources of these compounds, such as impurities in products produced by exhaustive chlorination or as by-products in the electrolytic production of chlorine. (Katz)
W77-05621

AQUATIC ENVIRONMENTAL QUALITY: PROBLEMS AND PROPOSALS,
Fisheries and Marine Service, Ottawa (Ontario). Oceanography Branch.
For primary bibliographic entry see Field 6G.
W77-05636

A LABORATORY MODEL FOR EVALUATING THE BEHAVIOR OF HEAVY METALS IN AN AQUATIC ENVIRONMENT,
Eastman Kodak Co., Rochester, N. Y. Health and Safety Lab.
For primary bibliographic entry see Field 5C.
W77-05644

BENTHIC FAUNAL DYNAMICS DURING SUCCESSION FOLLOWING POLLUTION ABATEMENT IN A SWEDISH ESTUARY,
Sweden Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5C.
W77-05647

SAMPLE COLLECTING APPARATUS,
Kabushiki Kaisha Hokushin Denki Seisakusho, Tokyo (Japan). (Assignee).
T. Yoshida.
U.S. Patent No. 3,985,028, 8 p, 3 fig, 3 ref; Officieal Gazette of the United States Patent Office, Vol 951, No 2, p 510, October 12, 1976.

Descriptors: *Patents, *Water pollution, *Industrial wastes, *Sampling, *Water sampling, Waste water, Measurement, Flow rates, Sources of pollution, Equipment, Water anaiysis.

This invention provides a sampling apparatus where small-amount samples can be successively collected from the stream of waste water in proportion to the flow rate of the stream and an entirely continuous measurement of the total amount of pollution substance in waste water can be obtained. The apparatus includes a piston cylinder which can receive a sample of the volume proportional to the measured flow rate and subsequently discharge the collected sample into sample collecting or storage means. During the sample collecting cycle, the piston moves by a distance corresponding to the measured flow rate during a constant period of time. This piston moving distance defines the amount of sample to be collected. During the subsequent sample discharging operation, the piston is quickly returned and the collected sample is discharged. These cycles are automatically repeated. (Sinha-OEIS)
W77-05652

LIQUID SAMPLING,
Pro-Tech, Inc., Malvern, Pa. (Assignee).
M. F. Irwin.
U.S. Patent No. 3,986,402, 5 p, 6 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 975, October 19, 1976.

Descriptors: *Patents, *Sampling, *Water sampling, Pollutants, *Pollutant identification, Automation, Physical properties, Homogeneity, Liquid wastes.
Identifiers: Simultaneous sampling.

Increasing emphasis upon quality of the environment has given rise to increased sampling of liquids for determination of composition, particularly component contaminants or pollutants. analysis for more than one component necessitates more than one sample, or at least more than one portion of the sample. Once a sample is in a collection container, however, a portion decanted from it is very likely to differ a good deal from what is left behind in the container so that simultaneous collection of like samples is appropriate and may be required. In general, the objects of this invention are accomplished wherin liquid is withdrawn from a body of liquid to flow past an intermittent diversion position and then back to the body of liquid. The flow of liquid is temporarily diverted into a region of confinement which has a number of outlets. Separate flowing streams of liquid are taken through respective outlets to the collection location where they are collected as individual samples. (Sinha-OEIS)
W77-05658

APPLICATION OF BIOLOGICAL ANALYSIS IN INVESTIGATIONS ON POLLUTED WATERS, (IN POLISH),
Wyzsza Szkola Rolnicza, Olsztyn-Kortowo (Poland). Instytut Hydrobiologii Ochrany Wodnego.
L. Turoboyski.
Pol Arch Hydrobiol 22(4), p 615-622, 1975.

Descriptors: *Bioassay, Water pollution, *Methodology, Analysis, *Organic wastes, *Pollutant identification, Analytical techniques.
Identifiers: *Biological analysis.

Various applications of biological analysis of polluted and pure waters and methods of interpretation are presented; 62 aspects of application of this analysis are discussed. It is inappropriate to confine biological analysis only to the evaluation of the degree of organic pollution on the basis of a saprobic system. A critical view of the mathematical interpretations of this system is presented.--Copyright 1976, Biological Abstracts, Inc.
W77-05662

CONCENTRATION AND DISTRIBUTION OF SELECTED TRACE METALS IN THE MAUMEE RIVER BASIN, OHIO, INDIANA, AND MICHIGAN,
Ohio State Univ., Columbus. Dept. of Geology.
For primary bibliographic entry see Field 5B.

W77-05671

WATER QUALITY INFORMATION STORAGE AND RETRIEVAL SYSTEM FOR HAWAII, FINAL REPORT, PHASE I AND II, (JULY 1971-OCTOBER 1973),
Hawaii Univ., Honolulu. Water Resources Research Center.
J. N. Miller.
Technical Memorandum Report No. 39, May 1974. 307 p, 5 fig, 8 ref, 5 append.

Descriptors: *Hawaii, *Water quality, *Data storage and retrieval, *Data collections, Data processing, Water pollution, *Computer programs.
Identifiers: Data reduction.

A computerized information storage and retrieval system (WQISAR) has been developed for water quality data colleced and maintained by the Department of Health, State of Hawaii, from 1955 through 1971. The system provides for safe, permanent, storage and rapid retrieval of water quality data. In addition to the ability to retrieve a systematically organized total data list, the capability also is present to compute, list and plot certain statistics basic to data reduction and analysis techniques. A catalogue of the major water quality stations in Hawaii with their respective agencies is included. Recommendations are presentd for the continued maintenance, development, and expansion of the WQISAR system. (See also W77-05673).
W77-05672

WATER QUALITY INFORMATION STORAGE AND RETRIEVAL SYSTEM FOR HAWAII, PHASE III: FINAL REPORT, (NOVEMBER 1973-SEPTEMBER 1974),
Hawaii Univ., Honolulu. Water Resources Research Center.
J. N. Miller, P. M. Muller, and A. L. Char.
Technical Memorandum No. 43, February 1975. 134 p.

Descriptors: *Hawaii, *Water quality, *Data storage and retrieval, *Computer programs, Water permits, *Potable water, *Mixing, Waste disposal, Effluents, Data collections, Data processing, Waste dilution.

A computerized system for the storage and retrieval of water qulity data and corresponding stations has been compiled for the Department of Health (DOH), State of Hawaii. Specific data banks include: zones of mixing, waste discharge and effluent, nonpotable water quality data, and the Water Resources Research Center's 'Quality of Coastal Waters' project data. The data processed along with certain station location catalogues has been prepared and delivered to the DOH. An initial updating scheme is presented for adding new data to the existing Phase I and II, DOH data sets. A detailed account of the methods employed, programs, and their usage is provided in Appendices A, B, and C. (See also W77-05672).
W77-05673

COLORIMETRIC METHOD FOR THE DETERMINATION OF ARSENIC(III) IN POTABLE WATER,
South Carolina State Coll., Orangeburg.
S. S. Sandhu.
The Analyst, Vol. 101, No. 1208, p 856-859, November, 1976. 11 ref, 4 tab.

Descriptors: *Water analysis, *Pollutant identification, *Colorimetry, *Arsenic compounds, Water pollution sources, Water chemistry, Water properties, Natural streams, Analytical techniques, Chemical analysis, *Potable water, Water quality.
Identifiers: *Arsenic(III).

A colorimetric method for the determination of arsenic(III) at a concentration of 0.002 mg/liter in potable water was developed. Arsenic(III) reacts quantitatively with potassium iodate in the presence of sulfuric acid and releases an equivalent amount of iodine, which imparts a pink color to a carbon tetrachloride extract. This color is measured at 520 nm. The method was used to differentiate between arsenic(III) and arsenic(V). No interference from arsenic(V), chloride, fluoride, or nitrate was observed. Natural water samples analyzed by this technique showed trace amounts of arsenic. (Witt-IPC)
W77-05677

AN ASSESSMENT OF VARIOUS TYPES OF REFERENCE ELECTRODE FOR USE IN CONTINUOUS POTENTIOMETRIC ANALYSIS WITH PARTICULAR APPLICATION TO HIGHLY PURE WATERS,
Central Electricity Generating Board, Leatherhead (England). Central Electricity Research Labs.
For primary bibliographic entry see Field 2K.
W77-05678

MEASUREMENT OF COMPLEXATION PROPERTIES OF HUMIC AND FULVIC ACIDS IN NATURAL WATERS WITH LEAD AND COPPER ION-SELECTIVE ELECTRODES,
Geneva Univ. (Switzerland). Dept. of Inorganic and Analytical Chemistry.
J. Buffle, F.-L. Greter, and W. Haerdi.
Analytical Chemistry, Vol. 49, No. 2, p 216-222, February, 1977. 5 fig, 29 ref, 4 tab.

Descriptors: *Water analysis, *Pollutant identification, *Humic acids, *Fulvic acids, *Electrodes, Electrochemistry, Analytical techniques, Hydrogen ion concentration, Natural streams, Copper, Lead, Water pollution sources.

The use of ion-selective electrodes for the measurement of the complexation properties of humic and fulvic acids is described. Values for mean molecular weight of the ligand, the stability constants of the complexes, number of ligands fixed per metal ion, and the dependency of the stability of the complexes on pH, may be obtained. The accuracy of the results is checked by comparing these results with those obtained by other methods and with known ligands. A comparison between this method and other existing methods for studying humic complexes is also made. (Witt-IPC)
W77-05679

DESIGN AND OPTIMIZATION OF A TEFLON HELIX CONTINUOUS LIQUID-LIQUID EXTRACTION APPARATUS AND ITS APPLICATION FOR THE ANALYSIS OF ORGANOPHOSPHATE PESTICIDES IN WATER,
Drexel Univ., Philadelphia, Pa. Dept. of Chemistry.
C. Wu, and I. H. Suffet.
Analytical Chemistry, Vol. 49, No. 2, p 231-237, February 1977. 4 fig, 11 ref, 13 tab.

Descriptors: *Water analysis, *Pollutant identification, *Organophosphorus pesticides, *Separation techniques, Water pollution sources, Analytical techniques, Water chemistry, Trace elements, Organic compounds, Phosphorus compounds, Pesticides, Sea water, Rivers, Sewage effluents, Pesticide residues.

A statistical optimization study is described, leading to the final equipment design and operational parameters for extraction of organophosphate pesticides with a new Teflon Helix Continuous Liquid-Liquid Extractor. A coil lenght of 32 ft, helix winding diameter of 1 inch, aqueous flow rate of 900 ml/hr, and water-to-solvent ratio of 10:1 (without premixing) were the optimal design parameters. Recoveries of microgram to nanogram/liter concentrations of organophosphate pesticides from fortified river water, sea water, and secondary sewage effluent were completed. Greater than 80% efficiency relative to batch extraction is demonstrated with continuous liquid-liquid extraction and continuous evaporative concentration. (Witt-IPC)
W77-05680

GAS CHROMATOGRAPHIC DETERMINATION OF TRACE AMOUNTS OF SULFUR COMPOUNDS IN INDUSTRIAL EFFLUENTS,
Leningrad State Univ. (USSR). Dept. of Chemistry.
A. G. Vitenberg, L. M. Kuznetsova, I. L. Butaeva, and M. D. Inshakov.
Analytical Chemistry, Vol. 49, No. 1, p 128-133, January, 1977. 6 fig, 16 ref, 3 tab.

Descriptors: *Water analysis, *Pollutant identification, *Sulfur compounds, *Gas chromatography, Analytical techniques, Water properties, Water chemistry, *Trace elements, Natural streams, Hydrogen sulfide, Sulfide, Industrial wastes, Effluents.
Identifiers: Mercaptans, Coulometry.

A method is described for the trace determination of hydrogen sulfide, mercaptans, sulfides, and disulfides in industrial effluents which is based on a combination of head-space analysis with microcoulometry. This method increases the analytical sensitivity 100 to 1000 times without any preliminary concentration of the sample. The factors affecting the precision and sensitivity of the analysis are discussed. A simple device was developed permitting injection and gas chromatographic analysis of solution under study without losses of the compound of interest. (Witt-IPC)
W77-05681

DETERMINATION OF URANIUM IN NATURAL WATER BY PRECONCENTRATION ON ANION-EXCHANGE RESIN AND DELAYED-NEUTRON COUNTING,
Atomic Energy Board, Pretoria (South Africa).
R. J. N. Brits, and M. C. B. Smit.
Analytical Chemistry, Vol. 49, No. 1, p 67-69, January, 1977. 2 fig, 17 ref, 2 tab.

Descriptors: *Water analysis, *Pollutant identification, *Anion exchange, Water pollution sources, Water chemistry, Water quality, Analytical techniques, Natural streams, Trace elements, Ion exchange, Radioactivity techniques.
Identifiers: *Uranium, *Neutrons.

A method is proposed for the determination of uranium in water. The uranium is extracted by sorption of the uranyl thiocyanide complex on an anion-exchange resin. The preconcentration step is largely independent of water quality and insensitive to experimental parameters. Uranium on the resin in directly determined by delayed-neutron counting, which is a specific and sensitive analytical method for uranium. The accuracy is 4% and the detection limit for a 1-liter sample is 0.04 micrograms/liter. (Witt-IPC)
W77-05682

STUDY OF A HUMAN POPULATION EXPOSED TO METHYLMERCURY FROM FISH CONSUMPTION, (IN FRENCH),
Siena Univ. (Italy). Laboratorio di Idrobiologio.
For primary bibliographic entry see Field 5C.
W77-05688

GAS-LIQUID CHROMATOGRAPHIC DETERMINATION OF DIFLUBENZURON (DIMILIN) IN WATER AS ITS TRIFLUOROACETYL DERIVATIVE,
Manitoba Univ., Winnipeg. Dept. of Soil Science.
B. L. Worobey, and G. R. B. Webster.
Journal of the Association of Official Analytical Chemists, Vol 60, No 1, p 213-217, January, 1977. 3 fig, 11 ref, 1 tab.

Descriptors: *Water analysis, *Gas chromatography, *Pollutant identification, Water pollution sources, Trace elements, Insecticides, Larvicides, Ponds, Analytical techniques, Water properties, Surface waters, Chromatography, Chemical analysis.
Identifiers: *Diflubenzuron(Dimilin).

A new gas-liquid chromatographic procedure has been developed for the analysis of diflubenzuron, 1-(4-chlorophenyl)-3-(2,6-difluorobenzoyl) urea, in pond water. The residue from fortified pond water were extracted with ethyl acetate, derivatized, and cleaned up on a mini Florisil column. The diflubenzuron was determined by gas-liquid chromatography as its N,N'-di(trifluoroacetyl) derivative, using electron capture detection. A 50% full scale deflection was obtained with 0.03 nanogram injected. Recoveries from fortified unfiltered pond water were 65.7, 72.8, 82.0, and 90.8% at the 0.020, 0.059, 0.197, and 0.788 mg/liter (ppm) levels, respectively. Recoveries from fortified filtered pond water were 94.1 and 89.3% at the 0.020 and 0.060 mg/liter levels, respectively. It is postulated that diflubenzuron is immobilized by adsorption, for example, to particulate organic matter in the pond water, because recovery data from unfiltered water followed the linear form of the Freundlich equation. (Witt-IPC)
W77-05691

EVALUATION OF XAD-2 FOR MULTIRESIDUE EXTRACTION OF ORGANOCHLORINE PESTICIDES AND POLYCHLORINATED BIPHENYLS FROM NATURAL WATERS,
Canada Centre for Inland Waters, Burlington (Ontario).
J. A. Coburn, I. A. Valdmanis, and A. S. Y. Chau.
Journal of the Association of Official Analytical Chemists, Vol 60, No 1, p 224-228, January, 1977. 13 ref, 3 tab.

Descriptors: *Water analysis, *Pollutant identification, *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, *Separation techniques, Resins, Pesticides, Water pollution sources, Water properties, Organic compounds, Analytical techniques, Chemical analysis, Trace elements, Natural waters, Canada, Ion exchange.

Amberlite XAD-2 resin was evaluated for multiresidue extraction of nanogram/liter levels of several organochlorine pesticides and polychlorinated biphenyls (PCBs) from fortified distilled water and unfortified natural waters. Recoveries from 1 litter distilled water samples fortified with 10-100 nanograms of 10 organochlorine pesticides averaged 96%. Recoveries averaged 85% for XAD-2 resin extraction of fortified natural samples collected from Canada. Unfortified control samples contained no detectable levels of any of the pesticides. The resin is not suitable for extracting mirex from natural water; only about 50% of added mirex was recovered. Recoveries of PCBs from 2 liter natural water samples, fortified with 250 nanograms of PCBs/liter and corrected for losses on the silica gel fractionation column and apparent PCB content of the control samples, ranged from 78 to 86%. Blanks for the resin extraction procedure were very low, averaging 4 nanograms of PCBs/liter. (Witt-IPC)
W77-05692

AUTOMATED ANALYTICAL SYSTEM FOR PHENOLS INCORPORATED INTO SCREENING METHOD SUITABLE FOR DETERMINATION OF 2-METHYL-4-CHLOROPHENOXYACETIC ACID AND/OR 2,4-DICHLOROPHENOXY-ACETIC ACID HERBICIDE RESIDUES IN WATER,
Norges Landbrukshoegskole, Vollebekk. Chemical Research Lab.
D. E. Ott, and H. O. Friestad.
Journal of the Association of Official Analytical Chemists, Vol. 60, No. 1, p 218-223, January, 1977. 3 fig, 11 ref, 1 tab.

Descriptors: *Water analysis, *Pollutant identification, *2,4-D, *Chlorinated hydrocarbon pesticides, *Phenolic pesticides, Pesticides, *Phenols, Water pollution sources, Herbicides, Trace elements, Colorimetry, Water properties, Organic compounds, Surface waters, Analytical techniques, Chemical analysis.
Identifiers: *2-Methyl-4-chlorophenoxyacetic acid.

2-Methyl-4-chlorophenoxyacetic acid (MCPA) and 2,4-dichlorophenoxyacetic acid (2,4-D) are extracted from water with methylene chloride and are degraded when heated in the presence of pyridine hydrochloride to their corresponding phenols which are determined automatically with a modified distillation-colorimetric analyzer system. The lower limit of detection of MCPA is about 50 micrograms/liter of water. Response for 2,4-D is almost identical to that for MCPA at equal concentrations. (Comparative responses to other possibly responding phenoxy acid herbicides have not been determined). MCPA results from this method for several water samples compared favorably with results from a gas chromatographic method. The semiautomated colorimetric method can be applied to water samples of unknown history as a screening method, in which case a significant positive recorder response (suitably corrected for free phenol response) indicates probability of presence of one or more of the responding herbicides. The sample would then need to be examined by other more definite means. (Witt-IPC)
W77-05707

VERTICAL DISTRIBUTION OF MERCURY, NICKEL, AND CHROMIUM IN LAKE ERIE SEDIMENTS,
Bowling Green State Univ., Ohio.
For primary bibliographic entry see Field 5B.
W77-05721

THE WATER QUALITY OF STREAMFLOW FROM PONDEROSA PINE FORESTS ON SEDIMENTARY SOILS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 5B.
W77-05734

WATER-QUALITY INVESTIGATION, SALINAS RIVER, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05751

COMPOSITION OF SELECTED RAIN SAMPLES COLLECTED AT MENLO PARK, CALIFORNIA IN 1971,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 7C.
W77-05754

CHEMICAL QUALITY OF GROUND WATER IN THE TEHAMA-COLUSA CANAL SERVICE AREA, SACRAMENTO VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
G. L. Bertoldi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 430/As, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-92, November 1976. 44 p, 12 fig, 9 tab, 35 ref.

Descriptors: *Water quality, *Groundwater, *Aquifers, *Chemical analysis, *Baseline studies, Irrigation water, Importedwater, *Irrigation canals, *California.
Identifiers: *Sacramento Valley (Calif), Tehama-Colusa Canal service area.

The Tehama-Colusa Canal Service Area consists of about 450 square miles of irrigable land located on the west side of the Sacramento Valley, Calif. Upon the completion of the Tehama-Colusa Canal, it is expected that most of the service area will switch from passive forms of agriculture (dry farming and grazing) to intensive irrigated farming. Importation and application of surface water may affect the chemical quality of native ground water. This study documents the chemical quality of native ground water before large-scale importation and application of surface water provide the potential of altering the ground-water chemistry. Analyses of samples from 222 wells show that most of the area is underlain by ground water of a quality suitable for most agricultural and domestic uses. In the vicinities of College City-Arbuckle and the city of Williams, boron, chloride, sodium, and dissolved solids may be a threat to future agricultural activities where boron- or chloride-sensitive crops would be grown. The source of degraded ground water in the two areas is local intermittent streams that drain areas having numerous saline springs and seeps. (Woodard-USGS)
W77-05756

GROUND WATER IN THE HARRISBURG-HALSEY AREA, SOUTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05757

WATER RESOURCES OF WASHTENAW COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich. Water Resources Div.
For primary bibliographic entry see Field 6D.
W77-05759

INDEX OF SURFACE-WATER STATIONS IN TEXAS, OCTOBER 1976,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 7C.
W77-05760

PROGRESS REPORT: JULY-SEPTEMBER 1974. EFFECTS OF SUPER-SATURATION OF DISSOLVED GASES ON FISH,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-05778

DISSOLVED GAS SUPERSATURATION, GRAND COULEE DAM PROJECT, 1973.
Seattle Marine Labs., Seattle, Wash.
Submitted to U.S. Department of the Interior, Bureau of Reclamation, Boise, Idaho. Contracts 14-06-100-7462 and 14-06-100-7507; U.S. Department of the Interior, Bureau of Reclamation, January, 1974, 82 p, 14 tab., 22 fig., 4 ref, append.

Descriptors: *Columbia River, *Grand Coulee Dam, Freshwater fish, *Monitoring, Spillways, On-site data collections, *Nitrogen, Hydroelectric power, *Dams, Dam sites, Fish diseases, Hydraulic turbines, *Supersaturation, Environmental effects, Spillways, Seasonal fish populations, *On-site investigations, Discharge(Water), Surface water, *Yellow perch, *Salmon.
Identifiers: *Gas bubble disease, *Lake Roosevelt, *Dissolved gas monitoring, Nitrogen partial pressures, Dissolved nitrogen, *Banks Lake, *Nitrogen supersaturation.

Dissolved gas monitoring of Lake Roosevelt indicated water with high N2 content throughout the reservoir. Changes in water temperature were found to have as great an effect on nitrogen partial pressures as changes in the concentration of dissolved nitrogen. Nitrogen partial pressures varied seasonally. Sampling of fish populations inhabiting the north end of Banks Lake showed no indication of gas bubble disease, nor did fish residing downstream from Grand Coulee Dam. (Katz)
W77-05787

WATER CHEMISTRY OF A STREAM FOLLOWING A STORM, ABSAROKA MOUNTAINS, WYOMING,
Wyoming Univ., Laramie. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W77-05800

DELINEATION OF THERMAL EFFLUENTS DISCHARGED INTO TROPICAL WATERS AROUND PUERTO RICO BY AERIAL INFRARED SCANNING,
Puerto Rico Nuclear Center, Mayaguez.
For primary bibliographic entry see Field 5B.
W77-05814

EFFICIENCY TEST ON FOUR HIGH-SPEED PLANKTON SAMPLERS,
Institute of Marine Research, Bergen (Norway).
For primary bibliographic entry see Field 7B.
W77-05836

ON THE RELIABILITY OF METHODS FOR QUANTITATIVE SURVEYS OF FISH LARVAE,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
For primary bibliographic entry see Field 7B.
W77-05837

TRICHLOROFLUOROMETHANE IN GROUND WATER - A POSSIBLE INDICATOR OF GROUND-WATER AGE,
Purdue Univ., Lafayette, Ind. Water Resource Research Center.
For primary bibliographic entry see Field 2F.
W77-05851

ALGAL GROWTH POTENTIAL OF WASTE WATER EFFLUENTS IN HAWAIIAN RECEIVING WATERS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 5C.
W77-05852

FISHERY WASTE EFFLUENTS: A METHOD TO DETERMINE RELATIONSHIPS BETWEEN CHEMICAL OXYGEN DEMAND AND RESIDUE,
National Marine Fisheries Service, Kodiak, Alaska. Utilization Research Lab.
J. Collins, and R. D. Tenney.
Fishery Bulletin, Vol. 74(4), p. 725-732, October, 1976. 4 tab, 3 fig, 5 ref.

Descriptors: Water pollution, Water quality, *Pollutants, *Industrial wastes, Effluents, *Canneries, *Chemical oxygen demand, Chemical analysis, Methodology, Monitoring, *Biochemical oxygen demand, Shrimp, Water pollution effects, Statistical methods, Regression analysis, Pollutant identification.
Identifiers: *Total suspended solids, *Settleable solids, Analysis of pollutants, Total chemical oxygen demand, *Filterable residue, *Non-filterable residue.

Researchers and the fishing industry have experienced difficulty in applying the Environmental Protection Agency's standard tests to industrial fishing waste effluents, especially for total suspended and settleable solids, and oil and grease. The relationship between chemical oxygen demand and residue was determined on a limited number of samples from four types of screened

waste effluents from November 1973 to September 1974: shrimp using fresh or salt water processing, snow crab and canned salmon. In addition to chemical oxygen demand and residue, tests for settleable solids, total suspended and settleable solids, oil and grease, protein, and salt were also performed. Based on these relationships, a method is suggested to develop a system for the analysis of pollutants that will be more economic and give more meaninful data than currently obtainable under Environmental Protection Agency's methods. The method requires that base data on a plant be obtained to relate chemical oxygen demand with residue values using regression lines and equations. A subsequent routine monitoring program need only test for total residue and chemical oxygen demand of the filterable residue. Substitution into the equations gives the other residue fractions and their chemical oxygen demand values, i.e. total chemical oxygen demand, chemical oxygen demand of the particulate matter, filtrable residue, and nonfilterable residue (Katz)
W77-05862

AN APPLICATION OF SYSTEMATIC SAMPLING TO A STUDY OF INFAUNA VARIATION IN A SOFT SUBSTRATE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Physiology and Biophysics.
S. Scherba, Jr, and V. F. Gallucci.
Fishery Bulletin, Vol. 74(4), p. 937-948, 1976. 3 tab, 33 ref.

Descriptors: *Sampling, *Statistical methods, *Sediments, Sediment distribution, Particle size, Mudflat, *Silt, *Aquatic habitats, Mollusks, Annelids, Benthic animals, Pollutant identification.
Identifiers: *Bivalves, *Polychaetes.

Stratified systematic sampling was applied to an intertidal macrofauna sediment study. A stratified systematic sampling plan retains the advantages of the more common fixed level transect sample, and possesses additional advantage which recommend it for use in some intertidal studies. The field data collectd in this study demonstrated the effectiveness of stratified systematic sampling for quantifying both sediment and population characteristics along a sediment gradient, and for the testing of biological hypotheses. Intraarea, interarea, and interseason hypotheses about sediment composition were tested in terms of particle size distributions. Populations of bibalves and polychaetes were simultaneously sampled and hypotheses concerning spatial and seasonal variations in an intertidal mud flat were tested. Experimental results using stratified systematic sampling suggest that Newell's hypothesis can be extended to encompass temporal variation. Fine sediemt grades (silty areas) may act to insulate infauna against the extremes of seasonal stresses. Sediment composition, as measured by the average percentage composition by weight of various grain sizes, was not sufficient to predict macrofaunal presence. (Katz)
W77-05863

PROCEDURE FOR HYGIENIC STUDIES IN DETERMINING LOCAL METHODS FOR PROTECTING WATER RESOURCES OF MARINE BODIES OF WATER, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5B.
W77-05878

BACK-CALCULATED FISH LENGTHS AND HG AND ZN LEVELS FROM RECENT AND 100-YEAR-OLD CLEITHRUM BONES FROM ATLANTIC COD (GADUS MORHUA),
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
J. S. Scott.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 147-150, 1977. 2 fig, 2 tab, 3 ref.

Descriptors: *Heavy metals, *Mercury, *Zinc, Laboratory tests, *X-Ray analysis, Marine fish, Commercial fish, Water pollution, Path of pollutants, Public health, *Pollutant identification.
Identifiers: *Atlantic cod, Muscle tissue(Fish), Bones(Fish).

Dimensions of cleithrum bones from recently caught Atlantic cod (Gadus morhua) were measured and plotted against observed fish lenghts to back-calculate cod lenghts from cleithra from a ship wrecked in 1865. Mercury levels in the historical bones were approximately the same as those in recent material and showed no increase with fish lenght, but zinc levels appear to have increased since 1865 and increased with fish lenght. (Katz)
W77-05879

THE PERFORMANCE OF ACTIVATED SLUDGE PLANTS COMPARED WITH THE RESULTS OF VARIOUS BACTERIAL TOXICITY TESTS - A STUDY WITH 3, 5-DICHLOROPHENOL,
Hoeschst A. G., Frankfurt am Main (West Germany).
For primary bibliographic entry see Field 5D.
W77-05886

A PROCEDURE FOR THE ROUTINE BIOLOGICAL EVALUATION OF URBAN RUNOFF IN SMALL RIVERS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
M. J. Pratt, and R. H. Coler.
Water Research, vol. 10, p. 1019-1025, 1976. 1 fig, 1 tab, 16 ref.

Descriptors: *Benthos, Aquatic life, Water quality, *Water pollution effects, *Bioindicators, *Monitoring, *Biological communities, *Methodology, Statistics, On-site data collections, *Urban runoff.
Identifiers: *Diversity index, *Artificial substrates, *Sublethal effects, Evenness index.

A rationale and stepwise procedure for the biological evaluation of urban runoff in small rivers is described. The protocol is predicated on the application of the Brillouin diversity index to collections of benthic macroinvertebrates isolated from artificial substrates in the course of a year. (Katz)
W77-05896

DATA FOR SUBSTANTIATING THE PERMISSIBLE LEVEL OF BORON CONTENT IN DRINKING WATER, (IN RUSSIAN),
Institute of General and Municipal Hygiene, Moscow (USSR).
For primary bibliographic entry see Field 5C.
W77-05898

RATE OF CONVERSION OF 14-C-P-P' -DDT TO P,P'- DDE BY BROOK TROUT (SALVELINUS FONTINALIS): ABSENCE OF EFFECT OF PRETREATMENT OF FISH WITH COMPOUNDS RELATED TO P,P' -DDT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5C.
W77-05905

INHIBITION OF MARINE ALGAL PHOTOSYNTHESIS BY HEAVY METALS,
Institute of Marine Biochemistry, Aberdeen (Scotland).
For primary bibliographic entry see Field 5C.
W77-05910

SYNERGISTIC EFFECTS OF CADMIUM AND SALINITY COMBINED WITH CONSTANT AND CYCLING TEMPERATURES ON THE LARVAL DEVELOPMENT OF TWO ESTUARINE CRAB SPECIES,
Duke Univ., Beaufort, N.C. Marine Lab.
For primary bibliographic entry see Field 5C.
W77-05912

COPPER, ZINC AND CADMIUM IN COASTAL WATERS OF THE N.W. MEDITERRANEAN,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
For primary bibliographic entry see Field 5B.
W77-05913

TRACE METALS IN SOUTHERN CALIFORNIAN MUSSELS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
G. V. Alexander, and D. R. Young.
Marine Pollution Bulletin, Vol. 7, No. 1, p 7-9, 1976. 6 fig., 1 tab., 5 ref.

Descriptors: *Mussels, *Mollusks, *Metals, Water pollution sources, *Absorption, *Bioindicators, *Zinc, *Nickel, *Copper, *Chromium, *Silver, *Lead, Metabolism, Animal physiology, Path of pollutants, Industrial wastes, Water quality, Wastes, Trace elements, Pollutant identification, California.
Identifiers: *Mytilus Californianus, *Bioaccumulation(Mussels).

The intertidal mussel Mytilus Californianus was found to be a useful bioindicator of anthropogenic inputs of several trace metals off Southern California. Highest metal concentrations were measured in the digestive glands. No significant differences attributed to sex were found for this tissue. The distribution of lead appeared to be dominated by diffuse inputs, while those of copper, chromium and silver were related to urban sources. No distinct pattern was observed for nickel or zinc. (Katz)
W77-05914

MERCURY IN PLANKTON FROM A POLLUTED NORWEGIAN FJORD,
Norsk Institutt for Vannforskning, Blindern.
J. M. Skei, M. Saunders, and N. B. Price.
Marine Research Bulletin, vol. 7, no. 2, p. 34-35, 1976. 1 fig, 2 tab.

Descriptors: *Plankton, *Mercury, *Metals, *Phytoplankton, *Zooplankton, *Fjords, *Primary productivity, *Toxicity, Pollutant identification, Aquatic productivity, Biomass, Biota, Bioassay, Eutrophication, Food chains, Industrial wastes, Path of pollutants, Water pollution, Sources, Methodology, Analytical techniques.
Identifiers: *Norway, Bioaccumulation.

Plankton of mixed composition was collected from 2 polluted fjords and analysed for total mercury content. Different methods of decomposing the samples prior to analysis were tested, showing no significant variations in the recovery of mercury. The high levels of mercury (0.52 - 25.2 ppm dry weight) were associated with industrial wastes. Indications of higher mercury concentrations in phytoplankton than in zooplankton were noticed and suggested a lack of food chain amplification within the lower trophic levels. (Katz)
W77-05915

ISOLATION AND IDENTIFICATION OF A POLAR METABOLITE OF TETRACHLOROBIPHENYL FROM BILE OF RAINBOW TROUT EXPOSED TO 14C-TETRACHLOROBIPHENYL,
Medical Coll. of Wisconsin, Milwaukee. Dept. of Pharmacology.
For primary bibliographic entry see Field 5C.
W77-05916

RESIDUES OF CHLORINATED HYDROCARBONS IN MARINE ORGANISMS IN RELATION TO SIZE AND ECOLOGICAL PARAMETERS, 1. PCB, DDT, DDE AND DDD IN FISHES AND MOLLUSCS FROM THE ENGLISH CHANNEL,
Institut fuer Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 5C.
W77-05917

A NOTE ON PLEXIGLAS HS FLUMES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
W. H. Robinson, Jr., and M. E. Wright.
Water Resources Research, Vol. 13, No. 1, p 211-212, February 1977. 4 fig, 1 ref.

Descriptors: *Water measurement, *Instrumentation, *Open channels, Flumes, Hydraulics, Discharge(Water), Effluents, Calibrations, Specifications, Low flow, Industrial plants, *Pollutant identification.
Identifiers: *HS flumes.

H flumes are convenient devices for accurate measurement of open channel flows, especially if trash is present. Several of the HS (smaller) types were constructed of plexiglas and used successfully in a commercial plant to measure effluents from vegetable washers. Lumped data from the calibration of three flumes were fitted to a curve of the form y=a(x to the b power). The correlation coefficient R squared for observed versus calculated values was 0.998. A 99% confidence band fitted to the prediction curve was very narrow, indicating the high degree of accuracy of the device. (Humphreys-ISWS)
W77-05965

ASBESTOS IN POTABLE WATER,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
W. H. Hallenbeck.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 389, Price codes: A05 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 118, January 1977. 78 p, 1 fig, 15 tab, 218 ref. OWRT A-071-ILL(1). 14-31-0001-6014.

Descriptors: *Potable water, Lake Michigan, Analytical techniques, *Asbestos, *Electron microscopy, *Rain, *Pollutant identification, Water supply, Path of pollutants, Illinois, Rain water.
Identifiers: *Chrysotile, *Carcinogenesis, *Precision of analysis, *Asbestos-cement pipe, Chicago, *Sources of asbestos.

Several published reports indicate that asbestos is found in public drinking water supplies. In order to determine the health effects of ingested asbestos relevant animal and human studies were reviewed. From these studies, it was not possible to predict potential health hazards associated with ingestion of the levels of asbestos found in drinking water. Detailed examinations of water samples were carried out by electron microscopy in order to determine the precision of analysis for waterborne asbestos. Asbestos-cement pipes, used to transmit drinking water, were studied under field conditions. No significant release of asbestos was observed. Preliminary work suggests that asbestos is present in Lake Michigan. An investigation of possible sources of asbestos into Lake Michigan indicated that wet deposition of asbestos may be a principal pathway of asbestos contamination of Lake Michigan. A feasibility study was carried out to determine if asbestos is present in rainwater collected in the Chicago area. Chrysotile asbestos was found in Chicago rainwater at a level of 10 to the 5th power to 10 to the 6th power fibers per liter. This finding demonstrates that precipitation scavenges airborne chrysotile asbestos which may result in the contamination of surface waters.
W77-06016

ANALYSIS OF DISSOLVED NITROGEN IN FISH BLOOD,
British Columbia Univ., Vancouver. Inst. of Fisheries.
H. H. Harvey.
Canadian Journal of Zoology, Vol. 39, 1961, p 905-909. 8 ref.

Descriptors: *Nitrogen, *Chemical analysis, *Methodology, Rainbow trout, Laboratory tests, Atmospheric gas, *Fish physiology, Biochemistry, Gases, Water quality, Pollutant identification.
Identifiers: *Gas analysis, *Dissolved nitrogen, *Fish blood, *Gas bubble diseases, Nitrogen supersaturation.

A procedure is described for the analysis of dissolved nitrogen in the blood of fish. The method was developed during an investigation into the dissolved nitrogen relationship of trout and their water environment utilizing an extraction and gas analyzer. (Katz)
W77-06022

DISSOLVED GAS SATURATION ANOMALIES AND EXCESS HELIUM IN THE OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.
H. Craig, and R. F. Weiss.
Earth and Planetary Science Letters, Vol 10, 1971. p 289-296, 2 fig, 15 ref.

Descriptors: Atlantic Ocean, Pacific Ocean, *Atmospheric gas, *Saturation, *Helium, Water quality, Laboratory tests, *Sea water, Supersaturation, Nitrogen, *Methodology, Measurement, Pollutant identification.
Identifiers: *Neon, *Neon supersaturation, *Saturation anomalies, Nitrogen-argon relationship, Excess helium, Radiogenic helium, Primordial helium.

New solubility measurements have been made for helium and neon in seawater; the results (published elsewhere) show that neon is actually supersaturated in the ocean, rather than generally undersaturated as indicated by previous data. The pattern of He-Ne-Ar saturation anomalies, based on the new solubility data, shows the presence of an injected 'atmospheric component' in Atlantic surface and deep waters and in Pacific deep waters, ranging from 0.5 to 1 ml of air (STP)/kg seawater. Nitrogen-argon relationships in the deep Pacific are also consistent with this effect. In addition to T and P, a third parameter is thus required for the study of saturation anomalies. The magnitude of the injected air fraction accounts for all of the 'excess He' in Atlantic Deep Water and about 60% of the excess in the Pacific. The non-atmospheric excess He in the Pacific corresponds to an anomaly of 3%, presumably radiogenic and primordial helium. (Katz)
W77-06024

MICRO GASOMETRIC DETERMINATION OF DISSOLVED OXYGEN AND NITROGEN,
Marine Biological Lab, Woods Hole, Mass.
P. F. Scholander, L. VanDam, C. L. Claff, and J. W. Kanwisher.
Biological Bulletin, Vol 109, 1955, p 328-334. 2 fig, 10 ref.

Descriptors: *Analytical techniques, Laboratories, *Dissolved oxygen, *Nitrogen, Water quality, *Chemical analysis, Inorganic compounds, Methodology, Gases, *Pollutant identification.
Identifiers: *Micro-gasometric determination, *Biological fluids.

A method is described for the determination of dissolved oxygen and nitrogen in polluted water and biological fluids for which the Winkler method is unreliable or not applicable. (Katz)
W77-06025

BONNEVILLE SPILLWAY NITROGEN TESTS, 29-30 OCTOBER 1972, SUMMARY OF RESULTS,
Corps of Engineers, Portland, Oreg. Hydraulic Section.
For primary bibliographic entry see Field 5C.
W77-06039

BONNEVILLE SPILLWAY TEST DEFLECTOR INSTALLATION IN BAY 18. PRELIMINARY EVALUATION REPORT ON NITROGEN TESTS,
Army Engineer District, Portland, Oreg. Hydraulic Section.
For primary bibliographic entry see Field 5C.
W77-06040

5B. Sources Of Pollution

FATE OF 2,4,5-T CONTAMINANT, 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD) IN AQUATIC ENVIRONMENTS,
Wisconsin Univ., Madison. Dept. of Entomology.
C. Ward.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 881, Price codes: A06 in paper copy, A01 in microfiche. M.S. Thesis, 1976. 108 p, 16 tab, 12 fig, 41 ref. OWRT A-058-WIS(2), 14-31-0001-4050, 14-31-0001-5050.

Descriptors: *Pesticide residues, *Pollutant identification, Pollutants, Water pollution sources, *Plant growth regulators, Analytical techniques, *Chromatography, *Lake sediments, Lakes, Path of pollutants, Herbicides, *2-4-5-T, Cxhlorinated hydrocarbon pesticides, *Microbial degradation.
Identifiers: *Lake water, *TCDD.

There has been recent concern about the use of the herbicide 2,4,5-T (2,4,5-Trichlorophenoxyacetic acid) because of the presence of small amounts of its contaminant TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin). TCDD is an extremely toxic compound and is also teratogenic at very low levels (microgram/kilogram). It is about a thousand times more toxic to rats than parathion and 100,000 times more toxic than DDT. This study describes the fate of TCDD in lake water and sediment by studying its microbial degradation, evaporation and adsorption to sediment. Under the experimental conditions described in the study, the following conclusions can be drawn: 1. TCDD is mostly bound with the lake sediment where it is stable and not very available for microbial degradation; 2. the binding of TCDD to unknown factors makes it difficult to recognize metabolic products; 3. the metabolism of TCDD that occurs in the aqueous phase is genuine, as judged by the freeze-drying technique, although the extent of metabolism is very small; 4. the metabolites are degraded faster than TCDD since metabolite production decreased with time, indicating an apparent case of intermediary metabolism; there is an optimum time for TCDD degradation (probably about one month) where the available TCDD is degraded, leaving the non-available TCDD in the sediment; 5. the conditions that favored the very limited degradation of TCDD were the presence of sediment, microbial activities and/or organic matter in the aqueous phase; 6. water-mediated evaporation of TCDD apparently occurred. (Diamantis-Wisc)
W77-05602

DISTRIBUTION OF FISH SPECIES IN GREAT BEAR LAKE, NORTHWEST TERRITORIES, WITH REFERENCE TO ZOOPLANKTON, BENTHIC INVERTEBRATES, AND ENVIRONMENTAL CONDITIONS,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
L. Johnson.

Journal of the Fisheries Research Board of Canada, Vol 33, No 11, p 1989-2004, 1975. 8 fig, 6 tab, 41 ref.

Descriptors: *Benthos, *Invertebrates, *Lake Trout, *Benthos, *Zooplankton, *Population, *Distribution, *Lakes, Temperature, Amphipoda, Gastropoda, Mayflies, Food chains, Trophic level, *Canada.
Identifiers: *Species diversity, *Great Bear Lake(NWT), Mysis relicta, Myoxocephalus quadricornis, Salvelinus namaycush, Whitefish, Coregonus clupeaformis, Stizostedion vitreum, Catostomuscatostomus, Couesius plumbeus, Percopsis omiscomaycus.

Benthic invertebrates in Great Bear Lake were concentrated, primarily in the upper 20 m and exhibited a high degree of patchiness. Densities between 20 and 100 m were low; below 100 m only Mysis relicta and Myoxocephalus quadricornis existed, in measurable densities. Lake Trout, Salvelinus namycush, and M. quadricornis were two species that inhabited the lake at all depths (3-400 m) and temperatures. Whitefish, Coregonus clupeaformis, inhabited only bays and water less than 20 m. The distribution of white fish was considered to be restricted mainly by the density of benthic organisms. Three species were confined to the periphery of the lake, Stizostedion vitreum, Lota lota, and Catostomus catostomus. Two species, Couesius plumbeus and Percopsis omiscomayus were present only in the headwaters and Great Bear River, but not in the lake. Extreme oligotrophy was considered to be responsible for reducing species diversity. (Katz)
W77-05612

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE ABSORPTION OF AMINO ACIDS BY ISOLATED GILL TISSUE OF THE BIVALVE, MYA ARENARIA (L.),
Queen's Univ., Belfast (Northern Ireland). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-05617

ORGANOCHLORINE INSECTICIDE RESIDUES IN DUCKLINGS AND THEIR DILUTION BY GROWTH,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 5C.
W77-05618

UPTAKE AND STORAGE OF 14C LABELED ENDRIN BY THE LIVERS AND BRAINS OF PESTICIDE SUSCEPTIBLE AND RESISTANT MOSQUITOFISH,
Mississippi State Univ., Mississippi State. Dept. of Entymology.
For primary bibliographic entry see Field 5C.
W77-05619

ISOLATION AND IDENTIFICATION OF POLYCHLORINATED STYRENES IN GREAT LAKES FISH,
National Water Quality Lab., Duluth, Minn.
For primary bibliographic entry see Field 5A.
W77-05621

MERCURY IN THE SURFICIAL SEDIMENTS OF LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
R. L. Thomas, and J. M. Jaquet.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 404-412, 1976. 6 fig., 3 tab., 27 ref.

Descriptors: *Mercury, *Toxicity, *Sediments, Metals, *Lake Erie, Suspended soils, Industrial wastes, *Water pollution sources, Quartz, Path of pollutants.

In 259 samples of the topmost 3 cm of sediment taken from Lake Erie in 1971, total mercury values ranged from 8 to 2929 ppb. The highest levels were in the Western basin adjacent to the Detroit River, the rest of the lake showing increasing concentration from the coarser sediments of the Inshore Zone and cross-lake moraine sills out into the basin muds. A quartz correction was applied to compensate for texture and dilution by an inert constituent. The distribution of quartz-corrected mercury confirmed that the Detroit River was the predominat source of industrial mercury to the Western basin with subsequent transport across the Central basin to final sink in the Eastern basin. Further possible inputs were indicated from Erie, Pennsylvania and Buffalo, New York. Analysis of suspended sediment in the Detroit River showed no change in concentration between 1970 and 1974 with a mean 1974 level of 1060 ppb. Mercury loading was estimated at 7.2 m t/yr to the sediments of the Western basin. A relationship was observed between total mercury and organic carbon, showing two distinct regressions: 'A' with lower organic-bound mercury was taken to represent the levels related to industrial and natural loadings existing prior to the introduction of mercury cell chlor-alkali plants; 'B' applicable to highly contaminated sediments, was believed to be indicative of loadings derived from the chlor-alkali industry. (Katz)
W77-05628

PROLONGED ORAL ADMINISTRATION OF METHYL MERCURY CHLORIDE TO RAINBOW TROUT (SALMO GAIRDNERI) FINGERLINGS,
Saskatchewan Univ., Saskatoon. Dept. of Veterinary Pathology.
For primary bibliographic entry see Field 5C.
W77-05629

ACUTE TOXICITY OF METHYL MERCURY CHLORIDE AND MERCURIC CHLORIDE FOR RAINBOW TROUT (SALMO GAIRDNERI) FRY AND FINGERLINGS,
Saskatchewan Univ., Saskatoon. Dept. of Veterinary Pathology.
For primary bibliographic entry see Field 5C.
W77-05630

RESIDUES OF ORGANOCHLORINE INSECTICIDES IN SOME FISHES AND BIRDS IN THE GEZIRA OF SUDAN,
Agriculture Research Corp., Wad Medani (Sudan).
For primary bibliographic entry see Field 5C.
W77-05648

DDT RESIDUES IN BENTHIC INVERTEBRATES AND DEMERSAL FISH IN ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 5C.
W77-05649

CONCENTRATION AND DISTRIBUTION OF SELECTED TRACE METALS IN THE MAUMEE RIVER BASIN, OHIO, INDIANA, AND MICHIGAN,
Ohio State Univ., Columbus. Dept. of Geology.
T. R. Schultz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 915, Price codes: A14 in paper copy, A01 in microfiche. M.S. Thesis, 1972. 309 p, 18 fig, 11 tab, 79 ref, 2 append. OWRT A-026-OHIO(2).

Descriptors: *Heavy metals, *Trace elements, *Sediments, *Path of pollutants, Ohio, Indiana, Michigan, Water pollution sources, Metals, *Sediment transport, *Sediment load, Spectrophotometry, Pollutant identification.
Identifiers: *Maumee River Basin(Ohio-Ind-Mich), Atomic absorption spectrophotometry.

The purpose was to survey the concentration and distribution of selected trace metals, some of which may be toxic, in the Maumee River basin. Reconnaissance by stream-sediment and water sampling was chosen as a means to accomplish this goal. Atomic absorption sepctrophotometry was the means of instrumental analysis. Sediment was analyzed to determine what concentration of metals might be readily available to organisms in the basin and also to establish a somewhat arbitrary maximum limit on what might be available. No conclusive relationships for the anamalous value were uncovered in analyzing the areal distribution. The lack of alarmingly high metal concentration should not create a false sense of safety. Direct cause and effect relationships have not been fully established between all trace metals and health. Was definitedly shown that in addition to routine water analyses, sediment should also be analyzed.
W77-05671

CASE OF A POLLUTED WATER PIPELINE, (IN RUSSIAN),
G. V. Sultanov, and G. R. Gadzhieva.
Gig Sanit 4, p 91, 1976.

Descriptors: *E coli, *Pipelines, Water pollution, *Sewage, Bacteria, Seepage, *Path of pollutants, *Public health.

A coli bacillus (Escherichia coli) index of 4 established in water quality control indicated the pollution of a separate drinking water line. It was caused by sewage water seeping from a nearby overfilled sewage hatch through holes in the asbestos-cement pipe and by unauthorized connection to the line by several residents.--Copyright 1976, Biological Abstracts, Inc.
W77-05687

EFFECTS OF KRAFT PULPING EFFLUENTS ON THE BENTHIC ALGAL POPULATIONS IN NORTHWESTERN SPAIN. I. DISTRIBUTION AND ABUNDANCE OF CHARACTERISTIC FUCACEAE (INCIDENCIA DE VERTIDOS INDUSTRIALES EN LA ESTRUCTURA DE POBLACIONES INTERMAREALES. I. DISTRIBUCION Y ABUNDANCIA DE FUCACEAS CARACTERISTICAS),
Instituto de Investigaciones Pesqueras, Vigo (Spain).
For primary bibliographic entry see Field 5C.
W77-05690

BIOLOGICAL DEGRADATION OF DIFFICULT-TO-OXIDIZE EFFLUENT COMPONENTS (BIOLOGICHESKAYA DESTRUKTSIYA TRUDNOOKISLYAENYKH KOMPONENTOV STOCHNYKH VOD),
For primary bibliographic entry see Field 5D.
W77-05716

VERTICAL DISTRIBUTION OF MERCURY, NICKEL, AND CHROMIUM IN LAKE ERIE SEDIMENTS,
Bowling Green State Univ., Ohio.
T. J. Wolery.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 965, Price codes: A10 in paper copy, A01 in microfiche. M.S. Thesis, 1973. 194 p, 28 fig, 13 tab, 71 ref. OWRT A-032-OHIO(2).

Descriptors: *Mercury, *Nickel, *Chromium, Sediments, *Lake Erie, Sedimentation, Surface waters, *Lake sediments, Distribution, Path of pollutants, Pollutant identification, *Sedimentation rates.
Identifiers: Methylation, *Vertical distribution(Pollutant).

Analyses of surface waters, surface microlayers, and interstitial waters showed negligible mercury contents in Lake Erie samples. A series of extrac-

tions on six sediment samples showed that the mercury was present in essentially three components: (1) high molecular-weight organic acids (30-54%), (2) lower molecular-weight organic acids believed to be held as insoluble complexes with iron under in situ conditions (5-20%), and (3) a sulfide (plus refractory organic) component (24-62%). Detailed depth profiles for mercury, nickel, and chromium in Lake Erie sediment cores showed that mercury was enriched in the surface sediments up to 114 times background levels. Chromium was typically enriched by a factor of 2-7, and nickel from 1-2. Georgraphically, the Western Basin showed the highest degree of heavy metal enrichment, and the Eastern Basin the Least. Pollutant mercury horizons were used to obtain sedimentation rates in the Western Basin using supplementary data from Kovacik (1972). A simplified model for the effect of sedimentation rate on the eventual remobilization of mercury via methylation showed two areas of high relative remobilization. The high sedimentation rates appear to be capable of negating the mercury hazard in the rest of the Basin without assistance from man.
W77-05721

A STUDY OF RUNOFF FROM SMALL RURAL WATERSHEDS IN RESPONSE TO COMPLETED AND PROPOSED LAND USE CHANGES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
M. J. Smith.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 900, Price codes: A06 in paper copy, A01 in microfiche. M. S. Thesis, 1972. 106 p, 12 fig, 23 tab, 40 ref. OWRT B-005-OHIO(13).

Descriptors: *Land use, *Land management, Hydrology, *Runoff, *Ohio, Agricultural watersheds, Water quality, Strip mines, Small watersheds, Watersheds(Basins), Watershed management, Strip mine wastes, Water pollution sources.
Identifiers: *Allegheny-Cumberland Plateau(Ohio).

The thesis pertains to the effect of land use and management upon the hydrology and water quality of two experimental watersheds; one, an agricultural area containing remnants of strip mining operations, and the other, a mixed cover agricultural watershed about to be subjected to a sharp upgrading of treatment. The analysis techniques used illustrate some procedures for determining changes in watershed hydrology. Longer period of study is recommended to make positive statements regarding changes in hydrologic response. (Chao-Ohio State)
W77-05728

THE WATER QUALITY OF STREAMFLOW FROM PONDEROSA PINE FORESTS ON SEDIMENTARY SOILS,
Arizona Univ., Tucson. School of Renewable Natural Resources.
P. W. Gregory.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 090, Price codes: A04 in paper copy, A01 in microfiche. M.S. Thesis, 1976. 64 p, 3 fig, 13 tab, 69 ref. OWRT A-066-ARIZ(3), 14-34-0001-6003.

Descriptors: *Streamflow, *Water quality, *Chemical analysis, *Arizona, Ponderosa pine trees, Forest management, Path of pollutants, Pollutant identification, Sediments, Sediment transport, Salts, Watershed management.
Identifiers: *Sedimentary soils, *Suspended sediment, Heber study area(Ariz).

The primary objectives were to characterize the chemical, physical and bacteriological quality of streamflow from ponderosa pine watersheds on sedimentary soil. The following relationships were statistically evaluated: (1) equality of mean water quality characteristics among watersheds and years; (2) correlation of discharge versus individual variable concentrations; (3) correlation of pH versus individual variable concentrations; (4) correlation of suspended sediment concentrations versus dissolved chemical concentrations; and (5) correlation of electrical conductivity versus total soluble salt concentrations. There was no significant difference in the mean variable concentrations among the watersheds. Therefore, differences in land use patterns and physical characteristics of the watersheds were significant regarding effects on average water quality. The mean concentrations from year to year were significantly different, particularly for the year 1973-74. The 1973-74 samples were all taken during the falling stage of streamflow, which could account for the yearly difference. Comparisons of water quality of ponderosa pine watersheds on sedimentary soils to EPA proposed criteria and to water quality of ponderosa pine watersheds on basalt soils were also made.
W77-05734

THE ENVIRONMENT OF SOUTH FLORIDA, A SUMMARY REPORT,
Geological Survey, Miami, Fla. Water Resources Div.
For primary bibliographic entry see Field 6G.
W77-05738

PHYSICAL, CHEMICAL, AND BIOLOGICAL ASPECTS OF SUBSURFACE ORGANIC WASTE INJECTION NEAR WILMINGTON, NORTH CAROLINA,
Geological Survey, Lakewood, Colo. Water Resources Div.
J. A. Leenheer, R. L. Malcolm, and W. R. White.
Available from the Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA 22202, Price $1.35. Professional Paper 987, 1976. 51 p, 34 fig, 36 tab, 29 ref.

Descriptors: *Waste water disposal, *Injection wells, Water pollution effects, *Industrial wastes, *Organic wastes, Data collections, Water analysis, Aquifers, Chemical analysis, Path of pollutants, Organic acids, Biodegradation, Chemical degradation, *North Carolina.
Identifiers: *Wilmington(NC).

From May 1968 to December 1972, an industrial organic waste was injected at rates of 100 to 200 gallons per minute into a sand, gravel, and limestone aquifer or Late Cretaceous age by Hercules Inc. located near Wilmington, North Carolina. This report presents both field and laboratory data pertaining to the physical, chemical, and biological effects of waste injection into the subsurface at this particular site, a case history of the operation, predictions of the reactions between certain organic wastes and the aquifer components, and descriptions of the effects of these reactions on the subsurface movement of the wastes. Dissolved organic carbon of the industrial waste averaged 7,100 mg/liter and 95 percent of the organic carbon was identified and quantified. The major organic waste constituents in order of decreasing abundance were acetic acid, formic acid, p-toluic acid, formaldehyde, methanol, terephthalic acid, phthalic acid, and benzoic acid. Prior to injection, the waste was neutralized with lime to pH 4 so that the major inorganic waste constituent was calcium at a concentration of 1,300 mg/liter. (Woodard-USGS)
W77-05739

BASIC DATA ON URBAN STORM-WATER QUALITY, PORTLAND, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
S. W. McKenzie, and T. L. Miller.
Open-File Report 77-594, 1976. 71 p, 1 fig, 4 tab, 11 ref.

Descriptors: *Urban runoff, *Storm runoff, *Water quality, *Water pollution sources, *Path of pollutants, Streamflow, Base flow, Storm water, Rainfall, Flow rates, Chemical analysis, Data collections, Sampling, Laboratory tests, Analytical techniques, *Oregon.
Identifiers: *Portland(Ore).

To assess urban storm-water-quality characteristics in the metropolitan area of Portland, Oreg., seven drainage basins were selected with varying drainage areas, basin slopes, impervious areas, land uses, and active construction areas. Automatic water-quality samplers, rain gages, and stream gages were installed in each basin. From September 1, 1975, to May 1, 1976, data were collected to determine rainfall intensities and stream discharge. Almost 500 samples from the seven basins were analyzed to describe pollutants for at least four complete storms on each of the basins. In addition to the storm samples, several baseflow samples were collected and analyzed for each site. Stream discharge and water-quality data are tabulated. (Woodard-USGS)
W77-05744

WATER-QUALITY INVESTIGATION, SALINAS RIVER, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
G. A. Irwin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 375/As, Price codes: A03 in paper copy, A01 in microfiche. Water-Resources Investigations 76-110, November 1976. 41 p, 1 fig, 12 tab, 6 ref.

Descriptors: *Water quality, *Baseline studies, *Trace elements, *Nutrients, *Pesticide residues, *California, Streams, Chemical analysis, Water pollution sources, Sewage effluents, *Dissolved solids, *Nitrogen, *Phosphorus, Carbon.
Identifiers: *Salinas River(Calif), *Total organic carbon.

Concentrations of dissolved solids in the Salinas River, California, are variable and range from 164 to 494 milligrams per liter near Bradley and from 170 to 1,090 milligrams per liter near Spreckels. Higher concentrations near Spreckels are caused mainly by sewage inflow about 150 feet (50 meters) upstream. Concentrations of nitrogen, phosphorus, total organic carbon, selected trace elements, and pesticides also generally increase downstream from Pozo to Spreckels and are related to sewage effluent; however, high concentrations occur elsewhere in the river. Specific conductance and water discharge regression results indicate that relations were all significant at the 1-percent probability level at Paso Robles, Bradley, and Spreckels with the explained variance ranging from 66 to 74 percent. Concentations of nitrogen, phosphorus, total organic carbon, and trace elements are only infrequently related to water discharge. (Woodard-USGS)
W77-05751

GEOLOGIC EVALUATION OF WASTE-STORAGE POTENTIAL IN SELECTED SEGMENTS OF THE MESOZOIC AQUIFER SYSTEM BELOW THE ZONE OF FRESH WATER, ATLANTIC COASTAL PLAIN, NORTH CAROLINA THROUGH NEW JERSEY,
Geological Survey, Raleigh, N.C. Water Resources Div.
P. M. Brown, and M. S. Reid.
Available from the Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA 22202. Professional Paper 881, 1976. 47 p, 5 fig, 10 plates, 2 tab, 10 ref.

Descriptors: Water storage, *Underground waste disposal, *Waste disposal wells, *Atlantic Coastal Plain, *Geological investigations, *New Jersey, *North Carolina, Drill holes, Well data, Evaluation, Feasibility studies, Subsurface mapping.

This report describes the distribution of subsurface environments in the Atlantic Coastal Plain--North Carolina through New Jersey, that are seen to have geologic potential for the storage of toxic waste. The environments described consist of layers of sand or sandstone, 20 feet or more in thickness, that are immediately overlain and underlain by layers of shale or clay, 20 feet or more in thickness, and which occur in Units F, G, and H of Mesozoic age in areas where the top of each of these units lies at a depth equal to or greater than 1,500 feet below mean sea level. Using a group of geologic parameters derived from or combining 20 categories of basic data, established from study of well cuttings and geophysical logs, a series of 18 regional maps was constructed. For each of three geologic units delineated in the subsurface, the maps illustrate the distribution of potential waste-storage reservoirs in terms of their areal extent, depth below land surface, an the thicknesses of the component reservoir and reservoir-seal rocks. (Woodard-USGS)
W77-05753

MAN-MADE TURBIDITY CURRENTS IN LAKE SUPERIOR,
Geological Survey, Menlo Park, Calif. Water Resources Div.
W. R. Normark, and F. H. Dickson.
Sedimentology, Vol 23, No 6, p 815-831, December 1976. 8 fig, 1 tab, 27 ref.

Descriptors: *Turbidity currents, *Lake Superior, *Mine wastes, *Inflow, *Flow rates, Distribution patterns, Water pollution sources.
Identifiers: *Taconite tailings, *Silver Bay(Minn).

This discharge of taconite tailings into Lake Superior at Silver Bay, Minnesota, produces turbidity current flow. The silty fine-sand tailings fraction transported to the deepest part of the lake has formed a small fan with valleys similar in gross morphology to a submarine fan. Current meters anchored 5 m above the lake floor over the wall and over the levee of a distributary valley on the fan recorded intermittent turbidity current flows during 30 weeks in 1972-73. At least twenty-five discrete periods of observation of turbidity current flow were obtained; single episodes lasted 4-328+ h. Only flows thick enough to overflow the eastern levee of the valley could be observed, and this accounts for the intermittent nature of observations, as flow within the valleys is expectd to be continuous as long as tailings are discharged. Flow velocities were higher near the valley axis where the flow is thicker. Velocities measured over the valley averaged 10.8 cm/s for eleven episodes; velocities measured over the levee, more than 1.5 km from the valley axis, only 3.3 cm/s. The maximum velocity during 1300 h of observation did not exceed 31 cm/s. This agrees reasonably well with velocities calculated from channel properties, as commonly done for turbidity currents on deep-sea fans. (Woodard-USGS)
W77-05762

DISSOLVED GAS MONITORING AT GRAND COULEE DAM AND LAKE ROOSEVELT,
Seattle Marine Labs., Seattle, Wash.
Submitted to the U.S. Department of the Interior, Bureau of Reclamation and State of Washington, Department of Ecology. (1972), 43 p. 8 tab, 8 fig, append.

Descriptors: *Columbia River, *Grand Coulee Dam, *Monitoring, On-Site Data collections, On-Site Investigations, *Nitrogen, *Hydraulic turbines, *Supersaturation, Environmental effects, Water temperature, Spillways, Dams, Dam sites, Dissolved oxygen, Seasonal, *Monitoring.
Identifiers: *Nitrogen supersaturation, *Spill season, *Dissolved nitrogen, Gas partial pressures, *Lake Roosevelt, Spokane River, Seasonal changes.

High nitrogen concentrations (22.5 to 26.3 ppm) downstream from Grand Coulee Dam during the spill season were due, in part, to the addition of dissolved nitrogen at the dam (4 to 5 ppm), and, in part, to the high nitrogen concentrations present in Lake Roosevelt water (20 to 22 ppm). A small amount of dissolved nitrogen (0.1 to 1.0 ppm) is added by the flow of water through the turbines. Partial pressures downstream from Grand Coulee Dam reached a peak of 148% of saturation in June. Nitrogen partial pressures in this area greatly exceeded levels normally considered detrimental to biological oranisms. The highest partial pressures, upstream and downstream from Grand Coulee Dam, occurred late in June and July. Actual nitrogen concentrations in these areas did not increase from the beginning of the study in April. The partial pressures reached a peak later than the actual concentrations of dissolved nitrogen due to the increasing temperatures during the sampling period. The major source of nitrogen concentrations in Lake Roosevelt is the Columbia River. Two Canadian sampling sites indicated that high nitrogen concentrations are present by the time the river reaches Trail, B.C. Of the smaller tributaries entering Lake Roosevelt, only the Spokane River appears to contribute a significant amount of dissolved nitrogen (Katz)
W77-05764

HYDROLOGICAL PARAMETERS AND GAS BUBBLE DISEASE IN A MARICULTURE POND AND FLOW THROUGH AQUARIA RECEIVING HEATED EFFLUENT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5C.
W77-05765

A DISCUSSION OF NITROGEN SUPERSATURATION OF COLUMBIA RIVER WATER IN RELATION TO BASIC PHENOMENON AND THE PHYSICAL LAWS OF GASES,
Chelan County Public Utility District, Wenatchee, Wash.
For primary bibliographic entry see Field 5C.
W77-05772

REPORT TO CORPS OF ENGINEERS, 1973 GAS SUPERSATURATION RESEARCH,
National Marine Fisheries Service, Longview, Wash. Prescott Field Station.
T. H. Blahm.
January 1974, 20 p., 4 tab., 2 fig. DACW-57-73-F-0314.

Descriptors: *Columbia River, *Anadromous fish, Chinook salmon, *Rainbow trout, *On-site investigations, Nitrogen, Supersaturation, *Bioassay, *Fish behavior, Water quality, Fish migration, Runoff, Monitoring, *Lethal limit.
Identifiers: *Nitrogen supersaturation, *Gas bubble disease.

A series of studies was conducted at the Prescott Field Station to determine the gas content of the Columbia River downstream from the dam system. Below the dam system during the high runoff period, bioassays were conducted to determine the lethal gas content to juvenile chinook and juvenile steelhead trout. Preliminary tests were made to determine vertical distribution on these fish in deep laboratory tanks or in the river. (Katz)
W77-05779

GAS SATURATION AND MODIFYING HYDROLOGICAL FACTORS IN ESTUARINE WATER USED FOR COOLING A STREAM ELECTRIC PLANT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 5C.
W77-05780

REPORT TO CORPS OF ENGINEERS GAS SUPERSATURATION RESEARCH, PRESCOTT FACILITY, 1974,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-05785

DISSOLVED GAS SUPERSATURATION IN THE COLUMBIA RIVER SYSTEM: SALMONID BIOASSAY AND DEPTH DISTRIBUTION STUDIES, 1973 AND 1974,
Parametrix, Inc., Bellevue, Wash.
D. E. Weitkamp.
For Northwest Utility Cooperative, c/o Idaho Power Company, Boise, Idaho. Parametrix, Inc., Environmental Services Section, Bellevue, Washington, Document No. 74-1227-11FR, 71 p., 10 tab., 15 fig., 12 ref. (1974).

Descriptors: *Fish diseases, *Supersaturation, *Salmon, *Rainbow trout, Dams, Fish migration, Fish behavior, Pathology, Nitrogen, Oxygen, *Bioassay, *On-site investigations, Mortality, Lethal limit, Depth, Juvenile fish, *Columbia River, Distribution, *Monitoring, Chinook salmon.
Identifiers: *Snake River, *Live-cage bioassays, *Gas bubble disease, Juvenile chinook salmon, Volition cages, *Depth distribution studies.

Live cage bioassays and depth distribution studies were made with juvenile salmonids in the Columbia River. At total dissolved gas supersaturation of 120% significant mortalities were encountered in fish held within 1 meter of the surface. Within 2 meters mortalities were observed only when the saturation was 125% or greater. Depth distribution studies in 1973 showed juvenile chinook salmon relatively close to the surface. Most steelhead were found within 1-2 meters. In 1974 fish were found in deeper waters with most fish at 2-4 meters. Under normal conditions, it was concluded that juvenile fish would be at depths which would preclude disease symptoms. (Katz)
W77-05786

PREDICTING DISPERSION COEFFICIENT OF STREAMS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
H. Liu.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 103, No. EE1, Proceedings Paper 12724, p 59-69, February 1977. 4 tab, 20 ref, 2 append.

Descriptors: *Dispersion, *Environment, *Open channels, *Pollution abatement, *Natural streams, *Streams, Fluid mechanics, Streamflow, Water pollution, Analytical techniques, Methodology, Model studies, Forecasting.
Identifiers: *Dimensionless dispersion coefficient, Bulk flow properties, Inspectional analysis.

A new dimensionless dispersion coefficient was derived for dealing with natural streams in which longitudinal dispersion results mainly from lateral rather than from vertical velocity gradients. Using inspectional analysis, a simple formula was derived which relates the longitudinal dispersion coefficient of natural streams to several bulk flow properties, such as the discharge and the hydraulic radius. The new coefficient is independent of the size of natural streams. Its magnitude depends both on the distribution of the dimensionless depth and on the discharge per unit width along the dimensionless transverse axis. Its value for any particular stream may be predicted from the frictional factor alone within a factor of about six. Although such an accuracy (or inaccuracy) is still not satisfactory, it is an improvement over all existing simple models. (Singh-ISWS)
W77-05803

NUMERICAL MODEL OF STRATIFIED ESTUARY FLOWS,
International Course in Hydraulic Engineering, Delft (Netherlands).
For primary bibliographic entry see Field 2L.
W77-05804

TYPES OF THERMAL PLUMES IN COASTAL WATERS,
Wisconsin Univ., Madison, Marine Studies Center.
T. Green, R. Madding, and F. Scarpace.
Water Research, Vol. 11, No. 1, p 123-125, 1977. 1 fig, 8 ref. NASA NGL 50-002-127, NSF GI-29731.

Descriptors: *Thermal pollution, *Powerplants, *Cooling water, *Lake Michigan, Heated water, *Path of pollutants, Water cooling, Water temperature, Coasts, Currents(Water), Heat transfer, Remote sensing, On-site investigations.
Identifiers: *Thermal plumes.

A large number of thermal images of the surface temperatures of the thermal plumes associated with the once-through cooling of electric power plants show that four kinds of plumes occur sufficiently often to be classified as distinct plume types. These types are: normal plumes, rough-water plumes, front-laden plumes, and meandering plumes. Each type of plume has implications for both numerical models and measurement strategies. (Sims-ISWS)
W77-05807

OBSERVATIONS OF THE MOTION FIELD OF THE CONNECTICUT RIVER PLUME,
Connecticut Univ., Groton. Marine Science Inst.; and Connecticut Univ., Groton. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2L.
W77-05808

LOCAL SCHEMES OF COMPLEX UTILIZATION AND PROTECTION OF WATER RESOURCES OF RIVER AND SEA BASINS IN THE NORTHERN CAUCASUS, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR).
G. A. Tsaturova.
Gig Sanit 4, p 88-89, 1976.

Descriptors: *Public health, Rivers, *Water supply, *Water utilization, Water resources development, Water pollution control, Water pollution sources, *Pollutant identification, *Bacteria.
Identifiers: *USSR(Northern Caucasus).

The development and partial implementation of sanitary principles for improved utilization of the Lower Don, Kuban, Terek, and Suslak rivers and the Azov and Caspian Seas (USSR) as water resources are discussed. The principles are based on studies on water pollution by household, industrial and agricultural waste and on the control of river flow and the construction of water reservoirs. Maps were constructed to assess changes in the organolepltic, physical and chemial, and sanitary and bacteriological indices of the water.--Copyright 1976, Biological Abstracts, Inc.
W77-05811

DELINEATION OF THERMAL EFFLUENTS DISCHARGED INTO TROPICAL WATERS AROUND PUERTO RICO BY AERIAL INFRARED SCANNING,
Puerto Rico Nuclear Center, Mayaguez.
E. D. Wood.
Presented to the American Society of Limnology and Oceanography 38th Annual Meeting, Halifax, Nova Scotia, June 23-26, 1975. 28 p, 14 fig, 5 ref.

Descriptors: *Remote sensing, *Thermal pollution, *Infrared radiation, *Puerto Rico, Aircraft, Aerial photography, Data processing, Powerplants, Nuclear powerplants, Cooling water, Bays, Estuaries, Instrumentation, Model studies, Mathematical models, Pollution, Effluents, Pollutants, *Path of pollutants, Tropical regions.
Identifiers: *Infrared scanners.

Aerial infrared scanning offers a versatile tool with which to monitor thermal discharges and a rapid method of detecting extraneous discharges whose temperatures differ from the ambient waters. Knowledge of the extent and distribution of thermal effluents is necessary to assist in determining the effects of the added heat upon biota of the region. An AGA Model 680 Thermovision infrared scanner with a 45 deg lens was mounted in a Cessna 182 and flown at altitudes of 600-2000 m during night and twilight hours. The detector was InSB, cooled with liquid nitrogen and sensitive to the range 2-5.6 micrometers. The picture was originally displayed on a color monitor which assigned ten arbitrary colors to shades of gray on the control unit. Isotherms have been assigned using coincidental surface measurements made with a thermometer, read to the nearest 0.1C. The data were then recorded on film. Ranges were set at 2C and 5C, and common sensitivities were 0.2C and 0.5C, respectively. More recently, the data have been recorded on magnetic tapes with a Sabre III instrumentation tape recorder. Observed data were compared to predictions made using the Pritchard Plume Model. Anomalies can be explained by boundary, wind, and tidal effects. (Sims-ISWS)
W77-05814

TRICHLOROFLUOROMETHANE IN GROUND WATER - A POSSIBLE INDICATOR OF GROUND-WATER AGE,
Purdue Univ., Lafayette, Ind. Water Resource Research Center.
For primary bibliographic entry see Field 2F.
W77-05851

A BIBLIOGRAPHY OF SOVIET LITERATURE ON FRESHWATER HYDROBIOLOGY AND RELATED PROBLEMS FOR 1975: PART 20, (IN RUSSIAN),
Y. Y. Tseeb.
Gidrobiol Zh 12(2), p 112-123, 1976.

Descriptors: *Bibliographies, *Hydrobiology, Parasitism, *Freshwater, Toxicity, Water pollution, Water chemistry, Microbiology, Chemistry, Public health, Invertebrates.
Identifiers: *USSR.

The bibliography lists 149 works on the following topics: freshwater hydrobiology, pollution and public health problems in hydrobiology, aquatic toxicology, invertebrate physiology, aquatic microbiology, surface water chemistry and the parasitology of freshwater invertebrates. Articles published in the Gidrobiologicheskii Zhurnal (Journal of Hydrobiology) are not included.--Copyright 1976, Biological Abstracts, Inc.
W77-05854

MERCURY IN FISH AND SHELLFISH OF THE NORTHEAST PACIFIC. I. PACIFIC HALIBUT, HIPPOGLOSSUS STENOLEPIS,
National Marine Fisheries Service, Seattle, Wash. Pacific Utilization Research Center.
A. S. Hall, F. M. Teeny, L. G. Lewis, W. H. Hardman, and E. J. Gauglite, Jr.
Fishery Bulletin, Vol. 74(4), p. 791-798, October, 1976. 5 tab, 3 fig, 10 ref.

Descriptors: *Pollutants, *Mercury, *Marine fish, Commercial fish, *Public health, *Pacific coast region, Alaska, Canada, Washington, Oregon, Chemical analysis, Biochemistry, Water pollution effects, Path of pollutants, Heavy metals, Pollutant identification.
Identifiers: *Pacific halibut, Hippoglossus stenolepis, *Muscle tissue(Fish), Bering Sea, Gulf of Alaska.

A Total of 1,227 Pacific halibut, Hippoglossus stenolepis, were analyzed for mercury content in the edible muscle tissue. These fish were obtained from five geographical areas within the species range: the Bering Sea, Gulf of Alaska, southeast Alaska, British Columbia, and Washington-Oregon. Mercury was uniformly distributed from nape to tail in the edible muscle tissue. Within each geographical area, the mercury concentration increased as the size of the fish increased. The mercury concentration also increased in fish of the same size from the northern to the southern part of the species range. (Katz)
W77-05865

COPPER AS AN INITIATING FACTOR OF VIBRIOSIS (VIBRIO ANGUILLARUM) IN EEL (ANGUILLA ANGUILLA),
Tromsoe Univ. (Norway). Inst. of Biology and Geology.
For primary bibliographic entry see Field 5C.
W77-05868

HEAVY METAL CONCENTRATIONS IN KIDNEYS OF ESTUARINE RACCOONS FROM FLORIDA,
Florida State Dept. of Health and Rehabilitative Services, Tallahassee. Health Program Office.
G. L. Hoff, W. J. Bigler, and J. G. McKinnon.
Journal of Wildlife Diseases, Vol. 13, p. 101-102, 1977. 1 tab, 7 ref.

Descriptors: Heavy metals, *Lead, *Cadmium, *Zinc, *Wildlife, Baseline studies, *Florida, Methodology, *Path of pollutants, Chemical analysis, Pollutant identification.
Identifiers: *Raccoons, Kidney tissue, Procyon lotor.

Concentrations of lead, zinc and cadmium in the kidneys of 14 adult raccoons from an estuarine environment were determined. The mean concentration in ppm wet weight and standard deviation for the metals were lead - 0.47 plus or minus 0.22, zinc - 75.88 plus or minus 16.54 and cadmium - 2.48 plus or minus 1.66. (Katz)
W77-05871

SIMAZINE RESIDUE DYNAMICS IN SMALL PONDS,
Fish and Wildlife Service, La Crosse, Wis. Fish Pesticide Research Unit.
W. L. Mauck, F. L. Mayer, Jr., and D. D. Holz.
Bulletin of Environmental Contamination and Toxicology, vol. 16, no. 1, p. 1-8, 1976. 4 tab., 10 ref.

Descriptors: *Herbicides, *Aquiculture, *Path of pollutants, *Absorption, Lakes, *Ponds, Persistence, *Pesticide residues, Fish farming, *Sunfishes, *Pre-emergents, Sediments, Benthic fauna, Longevity, Invertebrates, Fish management, Aquatic weed control.
Identifiers: Lepomis macrochirus, *Simazine.

Simazine, an aquatic herbicide, was applied to five test ponds in order to determine the long-term residue dynamics in mud, water, benthic invertebrates and fish. Bioaccumulation of simazine was evident only in invertebrates for the first 86 days although simazine was present in fish and invertebrates for at least a year. Simazine residues in water, invertebrates, and fish were similar to or less than treatment concentrations. Simazine residues may have persisted for so long because of the absence of vegetation at the time of initial application. The use of simazine as a pre-emergent herbicide for aquatic vegetation control has excellent possibilities in fishery management for manipulation of vegetative cover. No harmful effects resulting from chemical persistence were observed during the 2 years of the test. (Katz)

W77-05872

CHLORINATED HYDROCARBONS AND TOTAL MERCURY IN THE PREY OF THE WHITE-TAILED EAGLE (HALIAEETUS ALBICILLA L.) IN THE QUARKEN STRAITS OF THE GULF OF BOTHNIA, FINLAND,
Kuopio Univ. (Finland). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W77-05875

MOVEMENT OF MIREX FROM SEDIMENT AND UPTAKE BY THE HOGCHOKER, TRINECTS MACULATUS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
For primary bibliographic entry see Field 5C.
W77-05876

DDE POISONING IN WILD GREAT BLUE HERON,
South Dakota State Univ., Brookings. Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W77-05877

PROCEDURE FOR HYGIENIC STUDIES IN DETERMINING LOCAL METHODS FOR PROTECTING WATER RESOURCES OF MARINE BODIES OF WATER, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR).
G. A. Tsaturova.
Gig Sanit 1, p 54-56, 1976.

Descriptors: *Public health, Coasts, Bays, *Samples, Effluents, Water quality control, Water pollution sources, Methodology, Pollutant identification.
Identifiers: *Sea of Azov(USSR), *Caspian Sea(USSR).

A procedure for the sanitary-topographic study of coastal areas (e.g., Sea of Azov, Caspian Sea (USSR) used for human recration and thrapy (e.g., salt water baths) and of ports and bays in described. Surface water samples are collected by 2 connected floating bottles under various hydrometeorological conditions (e.e., calm weather, various wind velocities and directions). Samples of deeper water should be taken when effluents or suspended material is present. Locations for water quality control stations are recommended.--Copyright 1976, Biological Abstracts, Inc.
W77-05878

ACCUMULATION AND RELEASE OF FUEL-OIL-DERIVED DIAROMATIC HYDROCARBONS BY THE POLYCHAETE NEANTHES ARENACEODENTATA,
Texas A and M Univ., College Station. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-05881

INFLUENCE OF LIPID POOL SIZE ON BIOACCUMULATION OF THE INSECTICIDE CHLORODANE BY NORTHERN REDHORSE SUCKERS (MOXOSTOMA MACROLEPIDOTUM),
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W77-05887

CHLORINATED HYDROCARBON RESIDUES IN THE FISH IN LAKE TANGANYIKA,
Antwerpen Univ., Wilrijk (Belgium).
For primary bibliographic entry see Field 5C.
W77-05890

FATE AND EFFECT OF NAPHTHALENES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Skidaway Inst., of Oceanography, Savannah, Ga.
For primary bibliographic entry see Field 5C.
W77-05894

BIOLOGICAL TRANSPORT OF COPPER AT LOCH EWE AND SAANICH INLET: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Marine Lab., Aberdeen (Scotland).
G. Topping, and H. L. Windom.
Bulletin of Marine Science, vol. 27(1), p. 135-141, 1977. 7 fig, 5 tab, 10 ref.

Descriptors: *Copper, *Heavy metals, Water pollution effects, *Path of pollutants, On-site data collection, *Sedimentation, *Phytoplankton, *Zooplankton, Primary production, Bioassay, Correlation analysis, Biochemistry, Canada.
Identifiers: *Controlled experimental ecosystem, *Copper:carbon ratios, Settlement material, Saanich Inlet(BC), Lock Ewe(Scotland).

Chemical studies in experimental enclosures (CEEs) showed that a large percentage of added copper was lost from the water. The quality associated with settlement material was a small percentage of that lost. Loss by settlement, however, appeared to be directly proportional to the level of primary production, and was significantly correlated with carbon and to the concentration of soluble copper added. Copper:carbon ratios were higher in samples which consisted mainly of fecal pellets that in those constituted mainly of intact or fragmented phytoplankton. (Katz)
W77-05895

EFFECTS OF A SPILL OF MARINE DIESEL OIL ON THE ROCKY SHORE FAUNA OF LAMMA ISLAND, HONG KONG,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5C.
W77-05906

SEWAGE NUTRIENT ENRICHMENT AND PHYTOPLANKTON ECOLOGY ALONG THE CENTRAL COAST OF LEBANON,
American Univ., Beirut, (Lebanon). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W77-05911

COPPER, ZINC AND CADMIUM IN COASTAL WATERS OF THE N.W. MEDITERRANEAN,
International Lab. of Marine Radioactivity, Monte Carlo (Monaco). Oceanographic Museum.
R. Fukai, and L. Huynh-Ngoc.
Marine Pollution Bulletin, Vol. 7, No. 1, p 9-13, 1976. 5 fig, 2 tab., 11 ref.

Descriptors: *Metals, *Zinc, *Copper, *Cadmium, Coasts, Bodies of water, Water quality, Sampling, Water analysis, Wastes, Water pollution sources, *Sea water, *Path of pollutants.
Identifiers: *Mediterranean Sea, Marseille-Toulon area(France).

The concentration levels of copper, zinc and cadmium in the coastal waters of the Mediterranean were similar to those of off-shore waters without significant man-made contamination. The appearance of local high concentration for one metal by possible contamination was found to not necessarily correlate with high values for other metals, although some contamination sources elevated the concentrations of all three metals. In June 1974, the presence of a water mass having relatively high surface zinc concentration was observed off the Marseille-Toulon area. (Katz)
W77-05913

MANAGEMENT MODEL FOR WASTEWATER DISPOSAL ON LAND,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5E.
W77-05923

A TWO-DIMENSIONAL MATHEMATICAL MODEL FOR WATER QUALITY PLANNING IN ESTUARIES,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
V. L. Zitta, A. Shindala, and M. W. Corey.
Water Resources Research, Vol. 13, No. 1, p 55-61, February 1977. 7 fig, 4 ref.

Descriptors: *Water quality control, *Planning, *Estuaries, River basins, Flow, Temperature, Waste water, Management, Nitrogen, Dissolved oxygen, Biochemical oxygen demand, Equations, *Mathematical models, Systems analysis, *Simulation analysis, Forecasting, *Mississippi.
Identifiers: Sensitivity analysis, *Pascagoula River estuary(Miss).

A two-dimensional vertically well-mixed steady state intertidal model based upon the law of conservation of mass was developed to describe the distribution of chloride, nitrogen, biochemical oxygen demand, and dissolved oxygen within a geometrically complex estuary having interconnected tributaries and bayous. The model was verified against two sets of independent field data taken under different temperature and flow conditions within the Pascagoula River basin estuary. Application of the model under critical temperature and flow conditions was made to assess present water quality w ithin the estuary and to predict the effect of alternate wastewater management methods on the water quality within the estuary. The model was found to describe adequately the distribution of conservative and nonconservative substances within a complex estuarine system. It yielded results that correlated well with field data from two independent surveys collected under different conditions. The model can be used as a planning tool to assess present water quality conditions and to predict the effect of future development on the water quality within the estuary. Sensitivity analysis on the effect of various parameters on the response of the model revealed that the model is most sensitive to the dispersion coefficient.
W77-05926

BIOLOGICALLY MEDIATED WATER QUALITY DETERIORATION IN DISTRIBUTION SYSTEMS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W77-05928

APPLICATION OF A TRANSIENT FLOW MODEL TO COORDINATE URBAN STORM RUNOFF DATA WITH FLOW IN A RECEIVING RESERVOIR,
Tennessee Univ., Knoxville. Water Resources Research Center.
D. A. Summers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 204, Price codes: A03 in paper copy, A01 in microfiche. M.S. Thesis, December 1976. 39 p, 6 fig, 4 ref, append. OWRT A-043-Tenn(1), 14-34-0001-6044.

Descriptors: *Unsteady flow, *Urban runoff, *Mathematical models, Water quality, *Tennessee, Reservoirs, *Storm runoff, Streamflow, Methodology, Sampling, Flow, Model studies.
Identifiers: SOCH model, *Fort Loudoun Reservoir(Tenn), Transient flow model.

The purpose was to explore the problems faced in the application of the SOCH model, a mathematical transient flow model used by TVA, to an urban stormwater ruoff investigation to be conducted by the University of Tennessee Water Resources Research Center in Knoxville, Tennessee. The research sought to determine a method by which the model could be used to coordinate streamflow in Fort Loudoun Reservoir with water quality data taken shortly after precipitation events. Several methods of coordinating data and flow were conceived and tested from January to June, 1976. After encountering several problems in using the SOCH model, it was decided that the best use of the model was to guide sampling by following a single slug of water as it passed through Knoxville in Fort Loudoun Reservoir under conditions of runoff. During preliminary testing runs, the SOCH model was found suitable for use in an historical context only. This was due to a lag time encountered between the time of sampling and the time when input data for the model were available. Thus, to use the model to follow a slug of water, sampling had to be done in a manner which would accommodate flow coordination by the SOCH model at a later date.
W77-05931

FLOOD EFFECTS ON STREAM ECOSYSTEMS,
Soil Conservation Service, Little Rock, Ark.
For primary bibliographic entry see Field 4D.
W77-05949

AN EVALUATION OF SOME FLUORESCENT DYES FOR WATER TRACING,
Bristol Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W77-05950

ANNUAL AND SEASONAL FLOW VARIATIONS THROUGH THE STRAITS OF MACKINAC,
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W77-05958

CONVECTIVE-DISPERSIVE SOLUTE TRANSPORT WITH A COMBINED EQUILIBRIUM AND KINETIC ADSORPTION MODEL,
Department of Agriculture, Edmonton (Alberta). Soil Research Inst.
For primary bibliographic entry see Field 2G.
W77-05961

QUALITY CHARACTERISTICS OF URBAN STORM WATER IN SYDNEY, AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
I. Cordery.
Water Resources Research, Vol. 13, No. 1, p 197-202, February 1977. 3 fig, 4 tab, 7 ref.

Descriptors: *Urban runoff, *Storm water, *Water quality, *Water pollution sources, Urban hydrology, Foreign countries, Water pollution, On-site investigations, Data collections, Evaluation, Pollutants, Phosphates, Ammonia, Nutrients, Nitrates, Surface runoff, Suspended solids, Biological oxygen demand, Hydrogen ion concentration, Basins, Cities, Time of concentration, Discharge(Water), Coliforms, *Australia.
Identifiers: *Sydney(Australia).

Storm water samples collected from three urban watersheds in Sydney, Australia, showed that in separately sewered areas the surface runoff has a greater concentration and carries a greater total load of pollutants than effluent from secondary sewage treatment plants. Pollution and nutrient indicators are highly concentrated in the 'first flush' at the start of urban storm runoff, but these concentrations fall rapidly to quite low levels during the passage of each flood. An important exception of this trend is phosphate. The phosphate concentration remains approximately constant during each flood. Whenever the discharge increases sharply, the concentrations of suspended solids and phosphate increase slightly. However, the concentrations of BOD and ammonia do not usually increase after the first flush unless a later increase in discharge is extremely rapid. Fecal coliform concentrations in flood flows are usually about 2 orders of magnitude less than those for raw sewage. The shock load of polluting material from urban storm water can be very significant, especially for streams near inland cities. A flood which resulted from 13 mm of rain on a 131-ha watershed produced 1150 kg of suspended solids, 100 kg of 5-day BOD, 13 kg of phosphate, and 11 kg of ammonia in less than 1 hour. (Humphreys-ISWS)
W77-05963

TRANSIENT HEAT RELEASES FROM OFFSHORE NUCLEAR PLANTS,
Massachusetts Inst. of Tech. Cambridge. Energy Lab.
G. Jirka, D. W. Wood, and D. R. F. Harleman.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY2, Proceedings Paper 12743, p 151-168, February 1977. 12 fig, 14 ref, 2 append.

Descriptors: *Nuclear powerplants, *Cooling water, Model studies, *Mathematical models, Stratified flow, Powerplants, Mixing, Jets, Flow, *Heat transfer, Hydraulics, Hydrodynamics, *Forecasting, *Thermal pollution.
Identifiers: *Offshore nuclear powerplants, *Cooling systems.

A numerical predictive model for plants floating in semi-enclosed break water basins was developed. The model structure was provide by the significant vertical stratification which occurs within the breakwater basin during heat releases. Auxiliary dynamic equations were formulated for the processes of jet entrainment at the discharge, stratified flow through the breakwater openings, selective withdrawal at the submerged intakes, and heat dissipation to the atmosphere. Model predictions were compared with the results of experiments simulating constant heat releases, transient heat releases, and variable tidal conditons, respectively; satisfactory agreement was found. The predictive model was used to evaluate plant and breakwater design options for a proposed floating nuclear plant, the Atlantic Generating Station. The predictions demonstrated the importance of the stratified flow through the breakwater openings as the dominant ultimate heat sink mechanism, with surface heat dissipation playing a secondary role. (Sims-ISWS)
W77-05967

THE RESPONSE EQUATION METHOD: A NEW ROLE FOR SIMULATION OF ENVIRONMENTAL SYSTEMS,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
R. Willis.
In: Proceedings of the 1975 Winter Simulation Conference, Sacramento, California, December 18-19, 1975, p 665-668. (Published by Simulation Councils, Inc.) 18 ref.

Descriptors: *Surface waters, *Groundwater, *Methodology, *Equations, *Simulation analysis, *Optimization, *Water pollution control, Management, Decision making, Planning, Numerical analysis, Constraints, Mathematical models, Systems analysis.
Identifiers: *Response equation method, Minimization.

Management of complex environmental systems described by linear or nonlinear partial differential equations is typically accomplished by simulation of the response of the environmental system to alternative planning strategies. For differing combinations of alternatives, the simulation must be performed again; for a large number of alternatives, the efficacy of a particular strategy may be difficult to determine, due especially to the possible interactions between the system state variables. Recently, some of these problems have been obviated using a mixture of mathematical programming (optimization) and simulation. In many cases, however, the programming model is a simplified representation of the system, and the optimal planning strategies may or may not simulate the response of the system when other more complicating physical or hydrologic processes are considered. A new technique, the response equation method, is presented to address these problems in the management of point and non-point sources of pollution in surface and ground water systems. The technique begins with the partial differential equation describing the mass transport of contaminants. The equations are transformed using numerical techniques. The resulting sytem of equations is then imbedded in the constraint set of the management model: all the assumed physical processes are implicit within the optimization model. The optimal management decisions are then saved upon the actual response of the environmental system. (Bell-Cornell)
W77-05978

VERTICAL MIGRATIONS: SOME DATA ON THE AUTUMNAL BEHAVIOR OF ZOOPLANKTON IN A CANAL, (IN FRENCH),
Lille-1 Univ., Villeneuve d'Ascq (France). Lab. of Protistology and Microscopy Electronic.
N. Angeli.
Ann Limnol 11(3), p 239-253, 1975.

Descriptors: *Vertical migration, *Zooplankton, Seasonal, *Canals, *Autumn.
Identifiers: Alona-affinis, Bosmina-longirostris, Brachionus-angularis, Brachionus-calyciflorus, Chydorus-sphaericus, Cyclopidae, Filinia-longiseta, Keratella-cochlearis, Keratella-quadrata, Nauplii, Polyarthra-vulgaris.

In Nov., the vertical migrations of 9 planktonic metazoa (Brachionus calyciflorus, B. angularis, Polyarthra vulgaris, Filinia longiseta, Bosmina longirostris, Keratella quadrata, K. cochlearis, Chydorus sphaericus, Alona affinis) were observed in a canal of 2.60 m maximal depth. Sampling was performed every 3 h at 3 distinct levels over 24 h. Three successive ascendant movements occurring before and after dawn and close to twilight were shown by B. calyciflorus, B. angularis, P. vulgaris, F. longiseta and B. longirostris. A reversed migration was observed for 2 spp.: after sunset for K. quadrata, whose maximal density occurred near to the bottom at 23.00 h and close to noon for the nauplii of cyclopidae. From 23.00-02.00 h, the vertical distribution of the different species was almost uniform.--Copyright 1976, Biological Abstracts, Inc.
W77-05986

GRAZING AND DEBRIS BURNING ON PINYON-JUNIPER SITES--SOME CHEMICAL WATER QUALITY IMPLICATIONS,
Oregon State Univ., Corvallis. Rangeland Resource Program.
J. C. Buckhouse, and G. F. Gifford.
Journal of Range Management, Vol. 29, No. 4, p. 299-300, July 1976. 2 fig. OWRT A-022-UTAH(5).

Descriptors: *Water quality, *Range management, *Vegetation effects, *Grazing, *Burning, *Utah, *Pinyon pine trees, *Juniper trees, Phosphorus, Potassium, Runoff.
Identifiers: *Debris burning.

Significant increases in potassium and phosphorus were detected in overland flow from infiltrometer plots in southeastern Utah after debris burning.

Data collected during a water quality study in 1973 and 1974 on the location which had been chained to remove pinyon-juniper vegetation six years earlier indicated no treatment differences due to grazing (cattle stocking rate of 2 ha/AUM). Sites had since been seeded to crested wheatgrass. An undisturbed natural woodland bordering areas subjected to debris burning served as a control area. Runoff waters from simulated rainfall contained 0.2 ppm more phosphorus after burning in the debris-in-place treatment, a 400% increase in these levels. Release of nutrients from the pinyon-juniper debris piles apparently caused the increase of that element at the soil surface. A four-fold increase in potassium also occurred after the secondary treatment of burning. The K increase on the debris-in-place site continued throughout the 1974 field season. There were no significant treatment changes detected for sodium, calcium or nitrate-nitrogen. (Jahns-Arizona).
W77-05991

COUPLED OPTIMIZATION-SIMULATION WATER QUALITY MODEL,
Utah Water Research Lab., Logan.
A. B. Bishop, and W. J. Grenney.
Journal of the Environmental Engineering, Proceedings of the American Society of Civil Engineers, Vol. 102, No. EE5, p 1071-1086, October 1976. 2 fig, 12 tab, 16 ref. OWRT B-097-UTAH(3). 14-34-0001-6127.

Descriptors: *Water quality control, *Pollution abatement, *Simulation analysis, *Optimization, *Mathematical models, Streams, Costs, Sewage treatment, Standards, Waste water treatment, Planning, Constraints, Equations, Systems analysis.
Identifiers: *Integer programming, Cost minimization.

One of several considerations in river basin water quality management is determining treatment facilities needed to maintain stream quality standards. To deal with this problem, a stream water quality simulation model is coupled with a treatment cost minimization model. The optimization model is structured as an integer programming problem in which the integer decision variables are wastewater treatment levels to be determined for each discharger. The stream water quality simulation model, which relates pollution loading to stream quality response, generates the coefficients for the constraint equations in the optimization model. The model is applied to an example problem consisting of four pollution discharge points, at which seven possible treatment levels are available to remove four pollutant constituents. Water quality standards are imposed at five control points along the stream. Results of the optimal solution indicate the treatment level to be applied at each discharge point, the minimum total cost, and the stream quality conditions. (Bell-Cornell)
W77-05992

VERTICAL DIFFUSIVITIES IN AREALLY AVERAGED MODELS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
K. W. Bedford, and C. Babajimopoulos.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 103, No. EE1, Proceedings Paper 12753, p 113-125, February 1977. 3 fig, 28 ref, 2 append. OWRT B-063-OHIO(1).

Descriptors: *Diffusion, *Lakes, *Environmental engineering, *Stratification, *Water quality, Turbulence, Thermocline, Mixing, Heat transfer, Hydraulics.
Identifiers: *Clinolimnion, *Turbulent diffusion, Lacustrine deposits, Oxygen transport mechanisms.

Turbulent diffusivities and surface exchange coefficients for one-dimensional lacustrine transport are not only functions of the site, but they are also functions of whether the governing equation is areally averaged or not. Given the same initial conditions, nonaveraged equations require much higher values than areally averaged versions in order to predict the same temperatures or concentrations. To account for the effects of area averaging, research was performed to determine a quantitative relationship between the diffusivities and surface exchange coefficients in the two systems. It was found that the ratio of these values between the two systems is approximately equal to the ratio of average area of the heated surface water to the surface area. An exact solution for clinolimnion diffusivities also indicates the area independence. This empirical analysis was verified by comparing 1968 Cayuga Lake temperature predictions from the two different governing forms. (Singh-ISWS)
W77-05997

WATER QUALITY AS RELATED TO LINEARS, ROCK CHEMISTRY, AND RAIN WATER CHEMISTRY IN A RURAL CARBONATE TERRAIN,
Arkansas Univ., Fayetteville. Dept. of Geology.
G. H. Wagner, K. F. Steele, H. C. MacDonald, and T. L. Coughlin.
Journal of Environmental Quality, Vol. 5, No. 4, p 444-451, 1976. 4 fig, 6 tab, 12 ref. OWRT A-025-ARK(6).

Descriptors: *Arkansas, *Water pollution, *Chemical analysis, *Pollutants, *Water quality, *Water chemistry, Analytical techniques, Water pollution sources, Environment, Water, Trace elements, Wells, Groundwater, Spring waters, Rock properties, Calcium, Magnesium, Coliforms.
Identifiers: *Rock chemistry, *Carbonate terrain, *Chemical composition, Trace metals, Trace metal pollution, Plumbing contamination, Surface contamination.

Water from wells, springs, and streams from a 259 sq km area in rural, carbonate terrain of northwest Arkansas was analyzed for Na, K, Ca, Mg, NO3, PO4, and trace metals, Fe, Co, Cr, Ni, Cu, Zn, Cd, PB, Mn, Li, and Sr. Bacterial counts for total coliform, fecal coliform, and fecal streptococci were also made. The same area was mapped for linears by means of aerial photographs and field observations. Average rain water chemistry was determined for the year 1974, when the various water sources were sampled. The average chemical compositon of the St. Joe Limestone Member of the principal aquifer was determined from 22 samples collected in northwest Arkansas. Water sources on linears had higher nitrate and were more bacteriologically contaminated than those off linears. Trace metals pollution was negligible in all waters except for copper and zinc, which were high due to contamination from household plumbing. Rain water is the main source of trace metals for wells, springs, and streams; and limestone is the main source of Ca and Mg. Rain water is a prime source of Na and K; however, clay, shale, animal waste, and agricultural fertilizer probably also contribute Na and K. (Henley-ISWS)
W77-05998

TRACING SEWAGE EFFLUENT RECHARGE--TUCSON, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources; and Arizona Univ., Tucson. Coll. of Earth Sciences.
T. R. Schultz, J. H. Randall, L. G. Wilson, and S. N. Davis.
Ground Water, Vol. 14, No. 6, p 463-471, November-December 1976. 6 fig, 2 tab, 24 ref. OWRT A-056-ARIZ(3).

Descriptors: *Path of pollutants, *Sewage effluents, *Tracers, *Irrigation, *Groundwater, *Arizona, Model studies, Mathematical models, Monitoring, Sampling, Chemicals, Water pollution, Pollutants, Nitrates, Bacteria, Recharge, Groundwater recharge, Water wells.
Identifiers: *Santa Cruz River(Ariz), *Tucson(Ariz), Tracing techniques, Trichlorofluoromethane, Freon.

The treated sewage effluent from the City of Tucson treatment plant has historically been used for irrigation and/or dicharged to the normally dry Santa Cruz River. Numerous sampling programs have been undertaken to quantify the chemical quality, temperature, and micro-biological activity of the groundwater in the area near the Santa Cruz. Groundwater regions with high chloride and nitrite concentrations tend to be associated with areas irrigated with sewage effluent. Quality degradation due to channel recharge is not as evident because the effluent recharge is restricted by fine materials plugging the channel deposits. Recharging water tends to mound near the contact between the Recent and Fort Lowell formations, spreading laterally more rapidly than downward. A new tracer, trichlorofluoromethane (trade name Freon 11, C13CF), with applications similar to environmental tritium, is being evaluated. C13CF enters the hydrologic cycle when it is partitioned between the gas and liquid phases during raindrop formation. C13CF in water samples is separated and quantitatively measured by a gas chromatograph with pulsed electron-capture detector. Preliminary C13CF analyses of groundwater along the Santa Cruz do not correlate with nitrate values because mixing and increasing atmospheric C13CF concentrations were not accounted for. However, the presence of C13CF in the groundwater indicates recent recharge. (Sims-ISWS)
W77-05999

NONPOINT SOURCE POLLUTION FROM AGRICULTURAL RUNOFF,
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Engineering.
D. A. Haith, and J. V. Dougherty.
Journal of the Environmental Engineering Division, American Society of Civil Engineers, Vol. 102, No. EE5, Proceedings Paper 12481, p 1055-1069, October 1976. 1 fig, 7 tab, 39 ref, 2 append. OWRT B-030-NY(3).

Descriptors: *Water pollution sources, *Water quality, *Agricultural runoff, *New York, Nitrogen, Phosphorus, Water pollution, Model studies, Watersheds(Basins), Nutrients, Storm runoff, Surface waters, Estimating, Forecasting, Agriculture, Agricultural watersheds, Farm wastes.
Identifiers: *Nonpoint source pollution(Farm wastes).

An operational procedure was developed which is suitable for estimating nonpoint source water pollution due to runoff from agricultural land and is sensitive to regional variations in weather, soils, and crop management. Runoff was estimated using the Soil Conservation Service's semi-empirical runoff equation. Although not presently applicable to snowmelt runoff, the procedure could be extended to winter runoff by use of suitable estimating methods. Nitrogen and phosphorus in agricultural runoff were estimated for a five-watershed area totaling 578 sq km in Broome and Tioga Counties, New York, for the years 1971 and 1972. Comparison was made with two other estimates which were obtained using areal loading factors (losses of nutrients per unit area). Although the three different estimates were of comparable orders of magnitude, the loading factor estimates were not sensitive to the soils, weather, or crop distributions of the study region and may overstimate losses of nitrogen in agricultural runoff. (Humphreys-ISWS)
W77-06003

LABORATORY STUDY OF UNSTEADY ENERGY TRANSFER IN SURFACE LAYERS OF STRATIFIED WATER,
Purdue Univ., Lafayette, Ind. School of Mechanical Engineering; and Purdue Univ., Lafayette, Ind. Heat Transfer Lab.
For primary bibliographic entry see Field 2H.
W77-06006

INVERTEBRATES AND ORGANIC MATTER SWEPT ALONG DURING SPATES, AT THE INLET AND OUTLET OF THE KARSTIC SYSTEM OF BAGET, (IN FRENCH),
Toulouse Univ. (France). Lab. of Hydrobiology.
H. Decamps, and H. Laville.
Ann Limnol 11(3), p 287-296, 1975.

Descriptors: *Invertebrates, *Organic matter, *Karst, Decomposing organic matter, Environment, Subsurface flow.
Identifiers: *France(Baget), Spates.

More than 90% of the invertebrates swept along at the inlet of the system remain trapped inside the subterranean environment. The most important input appears during the 1st days of the spate; it is the same with the total organic matter per liter of water. The large and medium particles of organic matter form the most abundant fraction at the inlet of the system; dissolved organic matter is the most abundant fraction at the outlet.--Copyright 1976, Biological Abstracts, Inc.
W77-06007

THE EFFECT OF COAL SURFACE MINING ON THE WATER QUALITY OF MOUNTAIN DRAINAGE BASIN STREAMS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
R. A. Minear, and B. A. Tschantz.
Journal of the Water Pollution Control Federation, Vol. 48, No. 11, p 2549-2569, November 1976. 19 fig, 5 tab, 17 ref. OWRT A-041-TENN(2), NSF GI-35137, ERDA E-(40-1)-4946.

Descriptors: *Water pollution sources, *Water quality, *Tennessee, *Strip mines, Watersheds(Basins), Surface waters, Water pollution, Surveys, On-site investigations, Strip mine wastes, Coal mines, Runoff, Streams, Suspended solids, Sedimentation, Hydrogen ion concentration, Alkalinity, Turbidity, Chlorides, Sulfates.
Identifiers: *Cumberland Mountains(Tenn), *New River Basin(Tenn).

Six small watersheds, ranging from 1.7 to 11 sq km, within the New River Basin of the Cumberland Mountains of Northern Tennessee were monitored weekly and simultaneously for water quality between January and December 1975. Three watersheds were undisturbed by mining activity and served to establish bench mark data. The other three watersheds represented varying stages of coal mining activity, ranging from initiation of surface mining in one watershed to essentially complete stripping three years ago and current deep mining activity in another. Distinct differences were observed for the variables pH, alkalinity, sulfate, calcium, magnesium, iron manganese, total solids, and suspended solids among the disturbed watersheds. The undisturbed watershed stream constituent concentrations were quite uniform from stream to stream and from sample to sample. (Humphreys - ISWS)
W77-06012

EXPERIMENTAL AND SIMULATED TRANSPORT OF PHOSPHORUS THROUGH SANDY SOILS,
Florida Univ., Gainesville. Dept. of Soil Science.
R. S. Mansell, H. M. Selim, P. Kanchanasut, J. M. Davidson, and J. G. A. Fiskell.
Water Resources Research, Vol. 13, No. 1, p 189-194, February 1977. 8 fig, 2 tab, 24 ref. OWRT A-026-FLA(12). EPA R800517.

Descriptors: *Phosphorus, *Soils, *Sands, Laboratory tests, Model studies, Mathematical models, Phosphates, Phosphorus compounds, Adsorption, Chemical precipitation, Soil water movement, Leaching, Soil chemistry, Fertilizers, Pollutants, *Path of pollutants, Water pollution.
Identifiers: *Phosphorus transport.

Reversible equilibrium adsorption-desorption relationships were inadequate for describing the transport of orthophosphate through water-saturated and water-unsaturated cores from surface A sub 1 and subsurface A sub 2 horizons of Oldsmar fine sand. Using a kinetic model with nonlinear reversible adsorption-desorption improved descriptions of phosphorus transport through these soils. Phosphorus effluent concentrations were described best by using an irreversible sink for chemical immobilization or precipitation with a nonlinear reversible kinetic adsorption-desorption equation. (Sims-ISWS)
W77-06015

ASBESTOS IN POTABLE WATER,
Illinois Univ. at the Medical Center, Chicago. School of Public Health.
For primary bibliographic entry see Field 5A.
W77-06016

SATURATION VALUES OF DISSOLVED GASES ASSOCIATED WITH THE OCCURRENCE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT,
Duke Power Co., Charlotte, N.C.
For primary bibliographic entry see Field 5C.
W77-06034

BAY SPRINGS LAKE WATER QUALITY STUDY,
Army Engineer Waterways Experiment Station, Bicksburg, Miss.
S. C. Wilhelms.
In: Proceedings of Mississippi Water Resources Conference 1976, p 45-72. 11 fig, 9 plates.

Descriptors: *Inland waterways, *Water quality, *Simulation analysis, *Lakes, Rivers, Navigable waters, Transportation, Barges, Economics, Dissolved oxygen, Construction, Artificial lakes, Mathematical models, Temperature, Model studies, Isotherms.
Identifiers: *Hydrodynamic models, Thermal energy.

The Tennessee-Tombigbee Waterway is planned to allow barge traffic to reach the Tennessee River directly from Mobile, Alabama rather than requiring use of the more costly route through the Mississippi and Ohio Rivers. In order to determine the expected water quality in the Bay Springs Lake section of the waterway, procedures were developed to predict temperature and dissolved oxygen content of the waters within and released from the lake. The investigation utilized two physical models in conjunction with a mathematical model for purposes of simulating the temperature and dissolved oxygen patterns. These models are discussed in detail. A number of maps, drawings and photographs relevant to the study are included. Numerous tables showing the results of the study are also presented. (See also W77-06084) (Capehart-Florida)
W77-06087

HEAT CONTENT OF NORTH MISSISSIPPI RESERVOIRS,
Agricultural Research Service, Oxford, Miss. Sedimentation Lab.
F. R. Schiebe, J. C. Ritchie, J. R. McHenry, and Y. J. McGaha.
In: Proceedings of Mississippi Water Resources Conference 1976, p 93-102. 4 fig, 5 ref.

Descriptors: *Reservoirs, *Thermal capacity, *Analytical techniques, *Heat budget, Mississippi, Flood control, Temperature, Viscosity, Sedimentation, Energy, Specific heat, Density, Volume, Solar radiation, Conduction, Convection, Advection, Evaporation, Heat balance, Thermodynamics, On-site investigations, Data collections.

The content of a body of water affects the chemical and biological processes occurring within the water, the viscosity of the water, and the related sedimentation rate. The excess heat content is dependent on the water temperature and water volume. The fluctuations in water volume in a flood control reservoir make calculations of a heat budget difficult. The author presents the mathematical formulations used to make such a determination. Four graphs showing the actual behavior of specific reservoirs in Mississippi are included. (See also W77-06084) (Capehart-Florida)
W77-06088

FINAL REPORT ON FERTILIZER MOVEMENT THROUGH SOIL RESULTING FROM RAINFALL,
Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
H. T. Phung, J. F. Bartholic, and D. W. Buchanan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-247 487, Price codes: A03 in paper copy, A01 in microfiche. July 1975. 39 p, 15 fig, 4 tab, 24 ref.

Descriptors: *Nutrients, *Rainfall, *Fertilizers, Leaching, Irrigation effects, Agriculture, *Path of pollutants, Water pollution sources, *Soil water movement.

This study had a number of components in addition to the determination of nutrient loss from the orchard. Those additional components are discussed first since they provide background information needed to better interpret the results on nutrient loss. These parts include, first, a characterization of the soil in the orchard. Second, since soil moisture measurement was an important component, a brief discussion of the method used for determining soil moisture is included. The third part is a very major section involving evaluation of the water balance components occurring in the grove during the time nutrient loss was being determined. Because of their importance, figures for evapotranspiration are given by short periods for all of 1973. The fourth component covers nutrient loss from the peach orchard. This study involved over a thousand determinations of elements in the water outflow during the year-long study. Thus, it was possible to characterize in detail not only the major elements being leached from the orchard, but also minor elements. In addition, following the application of fertilizer, nutrients in the soil were monitored with respect to time after fertilizer application. Thus, considerable additional sampling was involved in characterizing the nutrients at three different depths versus time after application. (Skogerboe-Colo St)
W77-06096

SOURCES OF GAS SUPERSATURATION IN WATER,
Corvallis Environmental Research Lab., Oreg.
R. A. Garton, H. A. Salman, and F. C. Heller.
Presented at Western Division Meeting, American Fisheries Society, July 13, 1973, U.S. Environmental Protection Agency, 15 p., 8 fig., 16 ref.

Descriptors: *Supersaturation, *Atmospheric gas, Nitrogen, Dams, *Dam design, Spillways, Bonneville Dam, Grand Coulee Dam, Electric power, *Overflow, Reservoirs, Turbulence, Thermal power, Water pollution sources.
Identifiers: Little Goose Dam, Ruedi Dam, Morrow Point Dam, Yellowtail Dam, *Persistence of supersaturation, Physical requirements.

Gas supersaturation can occur in a number of ways. Sources of supersaturation are recognized, not because they are all the same, but because they satisfy the basic physical requirements. Deep plunge basins are typical of the Upper Columbia River and Snake River and contribute to the supersaturation problems. The extent of supersaturation varies with structure, mode of operation, and turbulence downstream from the outfall. (Katz)
W77-06100

5C. Effects Of Pollution

THE EFFECTS OF HEATED WATER DISCHARGE ON ZOOPLANKTON IN A 4,500 ACRE MISSOURI RESERVOIR,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
R. G. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 938, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, May 1974. 78 p, 11 fig, 3 tab, 91 ref. OWRT B-039-MO(4), 14-31-0001-3296.

Descriptors: *Thermal pollution, Reservoirs, *Zooplankton, Phytoplankton, *Standing crops, Heated water, Water pollution effects, *Missouri, *Chlorophyll, Copepoda, Crustaceans, Electric powerplants.
Identifiers: *Thomas Hill Reservoir(Mo).

Standing crops, species composition and species diversity of zooplankton were compared between two arms of a reservoir; the Hotwater Arm was thermally loaded while the Control Arm was under ambient temperature. Chlorophyll a in the two Arms was compared. Larval copepods and cladocerans were more abundant in the Hotwater Arm and rotifers were more abundant in the Control Arm. Species composition, and species diversity were similar in the two Arms. Population pulses were generally synchronous between Arms. There were little differences in chlorophyll a between Arms with the exception of a greater content in the Control Arm during summer. The heated water did not drastically reduce the abundance of zooplankton. (Witt-Missouri)
W77-05604

THE EFFECT OF A THERMAL EFFLUENT ON THE BENTHOS OF THOMAS HILL RESERVOIR, MISSOURI,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
C. W. Esterly.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 835, Price codes: A05 in paper copy, A01 in microfiche. M.S. Thesis, May 1975. 63 p, 15 fig, 9 tab, 30 ref. OWRT B-039-MO(5), 14-31-0001-3296.

Descriptors: *Thermal pollution, Reservoirs, *Benthos, *Biomass, Mayflies, Growth rates, *Missouri, Heated water, Water pollution effects, Electric powerplants.
Identifiers: *Thomas Hill Reservoir(Mo).

Numerical abundance, biomass, and species diversity of benthos were compared between two arms of a reservoir; the Hotwater Arm was thermally loaded while the Control Arm was under ambient temperature. Maximum surface temperature was 37 C while bottom muds varied between 8-29 C. Current drifted benthos and deposited them at the mouth of the Hotwater Arm, beneath the influence of the heated water. Numerical abundance and biomass of benthos were greater in the Control Arm than in the Hotwater Arm. During winter in the Hotwater Arm, numerical abundance and biomass were low because of predation by fishes. There was no difference in species diversity between the two Arms. There was no difference in the length-weight relationships of mayflies between the two Arms. Heated water had no apparent deleterious effects on the benthos. (Witt-Missouri)
W77-05605

STUDIES ON THE ALGAL POPULATIONS OF THE SAALE RIVER NEAR JENA: II. COMPARISON OF THE SEASONAL POPULATION DYNAMICS ABOVE AND BELOW THE CITY, (IN GERMAN),
Jena Univ. (East Germany). Biology Section.
W. Braune.
Limnologica 9(3), p 443-480, 1975.

Descriptors: *Algae, *Bacteria, *Chlorophyll, Cyanophyta, Chlorophyta, Chrysophyta, Euglenophyta, Cities, Fungi, Pyrrophyta, Seasonal, Rhodophyta, *Periphyton, Water sampling, Rivers.
Identifiers: Bryophyta, Flagellate, Rhodophyta, *Saale River(East Germany).

Periphyton and water samples were collected at monthly intervals from Sept. 1963-Sept. 1968. Of the 265 spp., varieties and forms found, 9 were bacteria, 42 Cyanophta, 130 Chrysophyta, 15 Euglenophyta, 1 Pyrrhophyta, 1 Rhodophyta and 1 Bryophyta, 2 Fungi, 2 unidentified colored flagellates and 3 unidentified colorless flagellates. Only quantitative distinctions could be made concerning the algae above and below the city (East Germany). A significant deficit of chlorophyll-containing algae was discovered below the city. The saprobity indices for this section were usually higher for the upstream section. The deterioration of water quality below the city is expressed in a modified microphyte population structure. (See also W76-12166)--Copyright 1976, Biological Abstracts, Inc.
W77-05606

TOXICOLOGICAL CHARACTERISTICS AND SYMPTOM-COMPLEX OF ACUTE PHENOL INTOXICATION OF CERTAIN FRESHWATER CRUSTACEANS AND MOLLUSKS, (IN RUSSIAN),
Gosudarstvennyi Nauchno-Issledovatelskii Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR).
V. A. Alekseev, and B. N. Antipin.
Gidrobiol Zh 12(2), p 37-44, 1976.

Descriptors: *Phenols, *Toxicity, *Crustaceans, *Mollusks, Daphnia, Invertebrates, Water pollution effects.
Identifiers: Acanthodiaptomus-denticornis, Anodonta-complanata, Asellus-aquaticus, Bithynia-tentaculata, Bythotrephes-longimanus, Cyclops-vicinus, Cypris-pubera, Daphnia-longispina, Daphnia-pulex, Dreissena-polymorpha, Eudiaptomus-gracilis, Lymnaea-stagnalis, Lynceus-brachyurus, Physa-fontinalis, Planorbis-planorbis, Planorbis-vortex, Polyphemus-pediculus, Radix-ovata, Sphaerium-corneum, Viviparus-viviparus.

Toxicological characters, LC100, LC50 and MTC (maximum tolerant concentration) are obtained for 20 spp. (Asellus aquaticus, Polyhemus pediculus, Daphnia longispina, D. pulex, Lynceus brachyurus, Bythotrephes longimanus, Acanthodiaptomus denticornis, Cyclops vicinus, Eudiaptomus gracilis, Cypris pubera, Physa fontinalis, Lymnaea stagnalis, Radix ovata, Viviparus viviparus, Bithynia tentaculata, Planorbis vortex, P. planorbis, Dreissena polymorpha, Anodonta complanata and Sphaerium corneum) of fresh-water crustaceans and mollusks. Resistance of the studied animals to toxins is explained as dependent on their morpho-physiological behavior and other peculiarities. In a symptom-complex of intoxication 5 main phases are distinguished in the development of the pathological process evoked by phenol intoxication, similar to those in other invertebrate species and typical of neuro-paralytic toxins.--Copyright 1976, Biological Abstracts, Inc.
W77-05607

AQUATIC ENVIRONMENTAL QUALITY: TOXICOLOGY,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
R. D. Hamilton.
Journal of the Fisheries Research Board of Canada, Vol. 33, p 2671-2688, 1976. 36 ref.

Descriptors: *Toxins, *Social impact, *Toxicity, Ecology, Aquatic environment, Education, Bioassay, Chemical wastes, Research and development, Monitoring, Environmental effects, *Canada.
Identifiers: Bioaccumulation.

Canadian research and control activities regarding the impact of toxic chemicals on aquatic environments were reviewed. Issues concerning the use of toxic chemicals were discussed and suggestions including economic, ethical, research and control-oriented aspects of toxicant use were recommended. (Katz)
W77-05608

ORGANOCHLORINE RESIDUES IN NEW ZEALAND BIRDS AND MAMMALS,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
J. W. Lock, and S. R. B. Solly.
New Zealand Journal of Science, Vol. 19, p. 43-51, 1976. 3 tab., 19 ref.

Descriptors: *Pesticides, *DDT, *DDE, *Chlorinated hydrocarbon pesticides, *Path of pollutants, *Bioassay, Mammals, *Birds, *Pesticide residues, Classification, Animal physiology, Food chains.
Identifiers: Bioaccumulation, *TDE, *HCB(Hexachlorobenzene), Residue levels, *Lindane, *New Zealand.

Six hundred twenty seven samples of wildlife, comprising sixty-one species of birds and sixteen species of mammals, were analysed for DDE, DDT, TDE, hexachlorobenzene (HCB), and lindane. Specimens were collected between 1966 and 1973 from the three main New Zealand islands, and from the Chatham, Kermadec, and Snares groups of Islands, Campbell Island, and Norfold Island. In birds, DDE was the predominant residue. Total DDT concentrations in muscle tissue varied according to habitat and feeding habits, and residues decreased in the following order: terrestial carnivores, terrestial omnivores, freshwater carnivores, estuarine carnivores, terrestial insectivores, marine carnivores, and inland herbivores. HCB was present in muscle of harrier hawks. In the fat of terrestial mammals, total DDT concentrations decrease in order: wild pigs, hares, rabbits, and chamois, deer and wild goats. The livers of dolphins and seals contain high levels of DDT. HCB was not detected in any mammal, and lindane was not detected in either birds or mammals. (Katz)
W77-05609

EFFECTS OF THE SYNERGIST PIPERONYL BUTOXIDE ON METABOLISM OF PESTICIDES IN GREEN SUNFISH,
Illinois Univ. at Urbana-Champaign. Dept. of Entomology.
K. A. Reinbold, and R. L. Metcalf.
Pesticide Biochemistry and Physiology. Vol 6, p 401-412, 1976. 4 fig, 4 tab, 11 ref.

Descriptors: *Pesticides, *Sunfishes, *Pesticide residues, *Toxicity, Aldrin, Dieldrin, Radioisotopes, Tracers, Biochemistry, Path of pollutants, Metabolism, Mode of action, Laboratory tests, Inhibitors, Inhibition, Bioassay, Chemical compounds, Enzymes.
Identifiers: Mechanism of action, Chemical mechanisms, *Synergists, *Piperonyl butoxide, *Green sunfish, Lepomis cyanellus, *Methoxychlor, *Trifluralin, Bioaccumulation, Autoradiography.

The effects of piperonyl butoxide on metabolism of Ctlabeled methoxychlor, aldrin, and trifluralin were investigated in green sunfish, Lepomis cyanellus. Piperonyl butoxide inhibited epoxidation of aldrin to dieldrin, O-dealkylation of methoxychlor, and N-dealkylation of trifluralin, resulting in higher levels of total radioactivity in animals exposed to the combination compared to those exposed to pesticide alone. Where piperonyl butoxide was present a greater proportion of the total radioactivity in the fish extract occurred as parent compound compared to metabolites than in fish exposed to pesticide alone. After 16 days of exposure piperonyl butoxide increased the proportion of parent compound eight times for methoxychlor, 17 times for aldrin, and 15 times for trifluralin. (Katz)
W77-05610

INFLUENCE OF SOCIAL RANK AND SIZE ON THERMOSELECTION BEHAVIOR OF BLUEGILL (LEPOMIS MACROCHIRUS),
Wisconsin Univ.-Madison. Dept. of Zoology.
T. L. Beitinger, and J. J. Magnuson.
Journal of the Fisheries Research Board of Canada, Vol 32, No 11, p 2133-2136, 1975. 1 fig, 1 tab, 21 ref.

Descriptors: *Temperature, *Fish behavior, Habitats, Growth stages, *Water temperature, Laboratory tests, Aquaria, *Sunfishes.
Identifiers: Lepomis macrochirus, *Thermoselection, *Social behavior, Fish size, Social interactions, Preferred temperature.

Juvenile bluegill (Lepomis macrochinus) were given a choice between an environment at their preferred temperature (31.0C) plus a social dominant or an environment either cooler (27.0C) or warmer (34.0C) than their preferred temperature, but with a large bluegill. During a 3 day control period when 20 small fish were isolated in individual experimental aquaria, each spent more than 75% of its time at 32.0C rather than warmer or cooler temperatures. After an adult was placed into the preferred temperature side of each aquaria, small fish spent nearly 3 days entire period at nonpreferred temperatures on the side without the larger bluegill. No significant correlation was found between length and selected temperatures of 35 individuals bluegill tested in a temporal temperature gradient. (Katz)
W77-05611

DISTRIBUTION OF FISH SPECIES IN GREAT BEAR LAKE, NORTHWEST TERRITORIES, WITH REFERENCE TO ZOOPLANKTON, BENTHIC INVERTEBRATES, AND ENVIRONMENTAL CONDITIONS,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5B.
W77-05612

TOXICITY OF POLYCHLORINATED BIPHENYLS (PCB'S) TO EUGLENA GRACILIS: CELL POPULATION GROWTH, CARBON FIXATION, CHLOROPHYLL LEVEL, OXYGEN CONSUMPTION, AND PROTEIN AND NUCLEIC ACID SYNTHESIS,
Armed Forces Radiobiology Research Inst., Bethesda, MD.
W. G. Ewald, J. E. French, and M. A. Champ.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 1, p 71-80, 1976. 8 fig, 18 ref.

Descriptors: *Growth rates, *Environmental effects, *Polychlorinated biphenyls, *Toxicity, *Water pollution effects, *Primary productivity, *Mode of action, *Bioassay, *Euglena, *Algae, *Respiration, *Photosynthesis, *Amino acids, Plant physiology, Chlorinated hydrocarbon pesticides, Laboratory tests, Aquatic plants, Carbon cycle, Chlorophyll, Protein.

Populations of Euglena gracilis in exponential growth were exposed to 2.5, 5.0, 7.5, and 10 ppm of Aroclor 1221. The level at which growth was inhibited by 50% after 48-hrs (ID 50/48) was estimated to be 4.4 ppm, while Aroclor 1232 resulted in an ID 50/48 of 55 ppm. No growth inhibition was observed with up to 100 ppm exposure of Aroclor 1242. Cell cultures exposed to 4.4 ppm of Aroclor 1221 for 48 hrs. had a reduced rate of carbon fixation and reduced levels of chlorophyll, while oxygen consumption was not affected at that level. Uptake of leucine in treated cultures was twice that of controls and uridine uptake was significantly lower while uptake of thymidine and incorporation of the three was unaffected. These results suggest that at the ID 50 level, PCB's reduce cell population growth in Euglena by inhibition of photosynthesis and/or chlorophyll production. (Katz)
W77-05613

ACUTE TOXICITY OF CADMIUM AND ZINC TO SEVEN INVERTEBRATE SPECIES FROM WESTERN PORT, VICTORIA,
Victoria Ministry for Conservation, Melbourne (Australia). Fisheries and Wildlife Div.
M. Ahsanullah.
Australian Journal of Marine and Freshwater Research, Vol 27, No 2, p 107-196, 1976, 5 tab, 16 ref.

Descriptors: *Heavy metals, *Cadmium, *Zinc, *Invertebrates, *Toxicity, *Bioassay, *Worms, Annelids, *Mollusks, *Insects, *Fish, *Phytoplankton, *Zooplankton, Lethal limit, Laboratory tests, Primary productivity, Animal physiology, Model studies, Water pollution sources, Australia, Mussels, Life stages, *Australia.
Identifiers: Bioaccumulation, Allorchestes compressa, Mytilus edulis, Palaemon sp., Neanthes vaali, Paraqrapsus quadridentus, Patiriella exiqua, Neotrigonia marqaritacea, Static bioassays, Continuous-flow bioassays.

The acute toxicity of cadmium and zinc to seven species of invertebrates animals from Western Port was determined using both static and continuous-flow bioassays. In the static bioassays, the species most sensitive to cadmium was Allorchestes compressa, followed by Mytilus edulis planulatus, Palaemon sp., Neanthes vaali, and Paraqrapsus quadridentatus, and the LC50 values ranged from 0.2 to 16.7 mg/1. The speceis most sensitive to zinc was A. compressa, then, in descending order of sensitivity, M.e. planulatus, Neanthes vaali, Palaemon sp., and Paraqrapsus quadridentatus, and the LC50 values ranged from 0.58 to 13.1 mg/1. Results for two other species, Patiriella exiqua and Neotriqonia margaritacea, were inconclusive because of the difficulty in determining the point of death. Continuous-flow bioassays were carried out on Palaemon sp., Paraqrapsus quadridentatus, and M.e. planulatus, and in general the LC50 values were higher than those in the static bioassays. (Katz)
W77-05614

EFFECTS OF LIGHT, MAGNESIUM, AND CYANIDE ON ACCUMULATION OF MERCURY BY A FRESH WATER DIATOM, SYNEDRA,
Tokyo Univ. (Japan). Inst. of Public Health.
M. Fujita, E. Takabatake, and K. Iwasaki.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 2, p 164-172, August 1976. 1 tab, 5 fig, 9 ref.

Descriptors: *Phytoplankton, *Absorption, *Adsorption, *Light, *Mercury, *Inhibitors, *Mode of action, *Path of pollutants, *Food chains, *Magnesium, Metals, Laboratory tests, Aquatic algae, Inhibitors, Diatoms.
Identifiers: *Synedra, *Bioaccumulation, Cyanide.

Phytoplankton has been shown to be an effective accumulator of mercury and an important contributor of mercury to organisms at higher trophic levels. Dividing, non-dividing and heat treated Synedra were exposed to labeled mercury in solution to determine the mode of uptake. Cells that were actively dividing contained more mercury than either of the other samples, after rinsing removed the loosely held mercury. The addition of Mg++ to a standard buffer solution caused mercury uptake which increased linearly with time. Mercury uptake was sluggish and eventually stopped in buffer without added Mg++. The optional concentration for mercury uptake was about 0.1mM of Mg++ Cyanide and azide, both inhibitors of respiratory enzymes, decreased mercury uptake. This suggest that mercury is taken up through a pathway linked to energy metabolism. It was also found that uptake was much higher under illumination than in the dark. (Katz)
W77-05615

EFFECTS OF HEAVY METALS ON FIN REGENERATION IN THE KILLIFISH, FUNDULUS HETEROCLITUS,
New Jersey School of Medicine, Newark. Dept. of Anatomy.
P. Weis, and J. S. Weis.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 2, p 197-202, August 1976. 1 tab, 1 fig, 21 ref.

Descriptors: *Cadmium, *Heavy metals, *Lead, *Mercury, *Environmental effects, *Metabolism, *Water pollution effects, *Mode of action, *Fish physiology, *Cadmium, Laboratory tests, Industrial wastes, Toxicity, Enzymes, Metabolism.
Identifiers: *Sublethal effects, *Fundulus sp.

Killifish were exposed to lead, cadmium, and mercury in order to determine the effects of these metals, environmental pollutants as a result of industrial waste discharge, on fin regeneration. Lead at 0.1 mg/1 seemed to have a slight accelerating effect on the rate of fin regeneration. Mercury was the most toxic to the killifish, but retardation of regeneration barely reached statistical significance at dose levels which were lethal to the fish before the end of the two-week experiment. Fish exposed to cadmium at 0.01, 0.1 and 1.0 mg/liter showed retardation in rates of fin regeneration that were not dose related. The problem appeared to be in the healing process rather than in actual fin growth. This may be due to reduced oxygen consumption as a result of a number of effects cadmium has on fish metabolism and biochemistry. (Katz)
W77-05616

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE ABSORPTION OF AMINO ACIDS BY ISOLATED GILL TISSUE OF THE BIVALVE, MYA ARENARIA (L.),
Queen's Univ., Belfast (Northern Ireland). Dept. of Zoology.
M. G. Stewart, and D. R. Bamford.
Journal of Experimental Marine Biology and Ecology, Vol 24, p 205-212, 1976. 2 fig, 3 tab, 18 ref.

Descriptors: *Absorption, *Amino acids, *Salinity, *Hydrogen ion concentration, *Water temperature, *Environmental effects, *Nutrients, *Clams, Crustaceans, Invertebrates, Laboratory tests, Methodology.
Identifiers: *Mya arenaria, *Gills.

The absorption of amino acids by isolated gill tissue of Mya arenaria was examined under conditions in which the environmental temperature, salinity, and pH were varied experimentally. A decrease in salinity resulted in a fall in amino-acid uptake. The maximum rate of L-histidine uptake increased with temperature, the Q10 for the range 5 to 15 C being 2.64. No significant effect of pH on amino-acid absorption was observed over the pH range 6.2-8.8. These results emphasize the need to

specify experimental conditions when substrate, uptake values are used to calculate the contribution made by an extra-alimentary absorption route to the nutritional economy of an animal. (Katz)
W77-05617

ORGANOCHLORINE INSECTICIDE RESIDUES IN DUCKLINGS AND THEIR DILUTION BY GROWTH,
Department of Agriculture, Lethbridge (Alberta). Research Station.
W. A. Charnetski.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 2, p 138-144, August 1976. 2 tab, 13 ref.

Descriptors: *Path of pollutants, *DDT, *DDD, *DDE, *Dieldrin, *Gadwall duck, *Chlorinated hydrocarbon pesticides, *Waterfowl, *Pintail duck, *Pesticide residues, *Animal growth, *Bird eggs, Pesticides, Insecticides, Ducks(Wild), Growth stages.
Identifiers: *Anas spp., *Mareca spp.

Residues of DNT, DDD, DDE and dieldrin in 7 species of ducklings from Alberta, Canada, were measured. Levels of DDT and metabolites ranged from 0 to 36.48 ppm in fat in 96% of the birds. Residue levels of dieldrin ranged from 0 to 2.62 ppm in fat and from 0 to 0.11 in muscle of 43% and 19% of the birds, respectively. Growth dilution was considered to be the most significant factor in reducing the insectcide residue levels in the ducklings. Total DDT, DDE, and DDD residue levels were decreased with increased weight for pintail (Anas acuta), baldpate (Mareca americana), and gadwall (A. strepera) ducklings. Dieldrin used in grasshopper control did not contribute to residue levels in the ducklings. Contamination by DDT was considered to have originated from outside the habitat. (Katz)
W77-05618

UPTAKE AND STORAGE OF 14C LABELED ENDRIN BY THE LIVERS AND BRAINS OF PESTICIDE SUSCEPTIBLE AND RESISTANT MOSQUITOFISH,
Mississippi State Univ., Mississippi State. Dept. of Entymology.
D. L. Fabacher, and H. Chambers.
Bulletin of Environmental Contamination and Toxicology, Vol 16, No 2, p 203-207, August 1976. 2 tab, 9 ref.

Descriptors: *Path of pollutants, *Pesticides, *Endrin, *Bioassay, Analytical techniques, *Absorption, Resistance, Model of action, *Fish physiology, *Toxicity, *Mortality, *Lethal limit, Laboratory tests, Methodology, Selectivity, Chlorinated hydrocarbon pesticides, Insecticides.
Identifiers: *Gambusia, *Mosquitofish.

A population of DDT-resistant mosquitofish, found to be resistant to most organochlorine pesticides, was exposed to 14C labeled endrin in a bioassay to determine the mechanism of their resistance. Amounts of endrin in brains and livers of resistant and susceptible fish at 20 ppb and at 1000 ppb were compared. At low concentrations, slower uptake of endrin in resistance, with endrin concentrations in brain and liver tissues 1.9 times higher in susceptible fish than in resistant. A more efficient blood-brain barrier in resistant fish could prevent large amounts of endrin from accumulating in the brain, thus accounting for a more rapid accumulation of endrin in lipid stores of the liver. The brains of resistant fish show a lower degree of binding of endrin than do those of susceptible fish which would account for endrin resistance. (Katz)
W77-05619

A HISTOLOGICAL STUDY OF THE RESPONSE OF THE INTERRENAL CELLS OF THE GOLDFISH (CARASSIUS AURATUS) TO TREATMENT WITH SODIUM LAURYL SULPHATE,
Aston Univ., Birmingham (England). Dept. of Biological Sciences.
N. R. Bromage, and A. Fuchs.
Journal of Fish Biology, Vol 9, No. 6, p. 529-538, December 1976. 3 tab., 25 ref.

Descriptors: *Detergents, *Pathology, *Cytological studies, *Water pollution effects, *Environmental effects, *Fish physiology, *Toxicants, *Metabolism, Analytical techniques, Laboratory test, Stress, Fish.
Identifiers: *Histology, *Sodium lauryl sulphate, *Sublethal effects, *Interrenal gland, Carassius auratus, Goldfish.

Treatment of goldgish (Carassius auratus) with sub-lethal concentrations of an anionic detergent, sodium lauryl sulphate, for 1,2 or 4 weeks produced histological changes in the interrenal (steroidogenic) cells of the head kidney which are indicative of a cellular activation. Significant increases in both the nuclear diameter of these cells and the number of nucleoli contained in the nuclei occurred after 1 week's treatment, although these effects were more pronounced after 2 and 4 weeks. There were little associated alterations in chromaffin cell activity. Preliminary experiments with another pollutant, zinc sulphate, suggest that it exerts a similar action to sodium lauryl sulphate on the interrenal cells. It is suggested the increases in corticosteroid production which occur after exposure of fish to sub-lethal concentrations of pollutants may be important in the development of a generalized disease syndrome and to the long-term success of fish populations. (Katz)
W77-05620

THE TOXICITY OF BENOMYL, THIOPHANATE-METHYL, AND BCM TO FOUR FRESH WATER ORGANISMS,
Rijksinstituut voor de Volksgezondheid, Bilthoven (Netherlands). Lab. for Toxicology.
J. H. Canton.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 2, p. 214-218, August 1976. 2 tab, 1 fig, 10 ref.

Descriptors: *Fungicides, *Lethal limit, *Toxicity, *Chlorella, *Daphnia, *Reproduction, *Rainbow trout, *Pesticide toxicity, Freshwater fish, Pesticides, Laboratory tests, Algae, Crustaceans.
Identifiers: *BCM, *Thiophanate-methyl, *Benomyl, *Sublethal effects.

Two-day toxicity studies were carried out to determine the LC50 of benomyl, thiophanate-methyl and BCM, three related fungicides, to freshwater organisms at different trophic levels. thiophanate-methyl proved to be the least toxic to all tested freshwater organisms. BCM was most toxic for Chlorella and Daphnia, while benomyl was the most toxic for the two test fishes, Salmo gairdneri and Lebistes reticulatus. Based on the influence of BCM on the reproductive capacity of Daphnia, a provisional level at which BCM would not affect the population-density in a natural eco-system was determined to be less than 16 micrograms/liter. More research has to be done to confirm this provisional figure. (Katz)
W77-05622

EVALUATION OF THE SHORT-TERM TOXICITY OF NITROGENOUS COMPOUNDS TO CHANNEL CATFISH, ICTALURUS PUNCTATUS,
California Univ. Davis. Dept. of Civil Engineering.
J. Colt, and G. Tchobanoglous.
Aquaculture, Vol. 8, p. 209-224, 1976. 4 fig., 2 tab., 29 ref.

Descriptors: *Toxicity, *Bioassay, *Channel catfish, *Lethal limit, *Nitrogen compounds, *Ammonia, *Nitrates, *Nitrites, *Aquiculture, *Toxicants, *Water temperature, Laboratory tests, Water quality control, Fish farming.

The acute toxicity of un-ionized ammonia, nitrite, and nitrate to 50-76-mm fingerling channel catfish (Ictalurus punctatus) was investigated using a static bioassay system at 22, 26 and 30 degrees C. The 96-h LC50 values at 30 degrees C for un-ionized ammonia, nitrite, and nitrate were 3.8, 44, and 6,200 mg/l. (Katz)
W77-05623

TRACE METAL LEVELS IN EELS GROWN IN POWER STATION COOLING WATER,
Central Electricity Generating Board, Southampton (England). Marine Biological Lab.
M. G. Romeril, and M. H. Davis.
Aquaculture, Vol. 8, p. 139-149, 1976. 5 tab., 10 ref.

Descriptors: *Trace elements, *Eels, *Aquiculture, *Environmental effects, *Water temperature, *Heavy metals, *Cooling water, Power plants, *Cadmium, *Zinc, *Copper, *Iron, *Public health, Absorption, Analytical techniques, Industrial wastes, Path of pollutants, Commercial fish, Heated water, Thermal pollution.
Identifiers: Bioaccumulation, *Anguilla anguilla, Tissue analysis, Bristol Channel.

Measurements have been made of heavy metal concentrations in eels grown in condenser discharge water and cooling-tower pond water to ascertain if abnormal metal accumulation occurs under these conditions. Eels from other locations were also analyzed to provide comparative data. Cadmium, copper, iron, nickel and zinc concentrations were measured in liver and muscle tissue. Comparison of the metal concentrations in the eels maintained in the three experimental regimes with those from other sites does not indicate any abnormal accumulation in those fish kept at an elevated temperature. The fastest growing eels in condenser water appear to develop new issues more rapidly than they accumulate metals, thus reducing the specific metal concentration. There is considerable variation in metal concentrations in eels, with particularly high liver cadmium concentrations being observed in eels collected from polluted areas of the Bristol Channel. Muscle cadmium levels, however, are generally low and constant and would not appear to constitute a human health risk from food consumption. (Katz)
W77-05624

TOXICITY OF MALACHITE GREEN TO CULTURED AMERICAN LOBSTER LARVAE,
California Univ., Bodega Bay. Bodega Marine Lab.
W. S. Fischer, T. R. Rosemark, and R. A. Shleser.
Aquaculture, Vol. 8, p. 151-156, 1976. 4 fig., 8 ref.

Descriptors: *Aquiculture, *Commercial shellfish, *Fungicides, *Antibiotics(Pesticides), *Toxicity, *Bioassay, *Larvae, *Lobsters, *Shellfish farming, *Mortality, Laboratory tests, Shellfish, Crustaceans, Invertebrates.
Identifiers: *Malachite green.

Malachite green has been used to control fungal and epibiotic infestations of larval lobsters. The concentration of malachite green and the exposure period are critical to survival. The effects of increasing concentrations and exposure periods show survival to be adversely effected with treatments above 8 ppm for 16 min and above 20 ppm for 8 min administered every other day throughout the larval period. Development of the larvae is retarded with increasing treatment levels. Survivors of high treatment levels show no immediate post-treatment effects. (Katz)
W77-05625

SEAWATER ADAPTATION IN ATLANTIC SALMON (SALMO SALAR L.) AT DIFFERENT EX-

PERIMENTAL TEMPERATURES AND PHOTOPERIODS,
Institute of Marine Research, Bergen (Norway).
S. Knutsson, and T. Grav.
Aquaculture, Vol. 8, p. 169-187, 1976. 2 tab., 9 fig., 16 ref.

Descriptors: *Environmental effects, *Water temperature, *Growth rates, *Atlantic salmon, *Smolt, *Photoperiodism, *Animal physiology, Fish behavior, Seasonal, Laboratory tests, Salmon, Salmonids, Life cycles, Fish migration, Size, Mortality.
Identifiers: Smolting.

A study was made of the effect of gradually increasing day length at different temperatures on the smolting process and on growth of Atlantic salmon during smolting. The experiment consisted of ten experimental groups; a combination of three photo-period with three temperature-groups and a tenth control group. Size was found to be the most important factor in seawater adaptation of underyearling Atlantic salmon. Optimal growth in the experimental temperature and photoperiod regimes occurred at 15 degrees C and at the photoperiod with the longest period of increasing day length. At the time for seaward migration, the most pronounced effect to photoperiod on seawater adaptation occurred at 11 degrees C. At this temperature there was a significantly higher percentage of survivors at the photoperiod with the longest period of increasing day length. (Katz)
W77-05626

POLYCHLORINATED BIPHENYLS (PCB'S) IN THE RIVERS AVON AND FROME,
Ghana Academy of Sciences, Accra. Inst. of Aquatic Biology.
A. E. Kpekata.
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 6, p. 687-691, 1975. 1 fig., 3 tab., 6 ref.

Descriptors: *Aroclor, *Chlorinated hydrocarbon pesticides, *Polychlorinated biphenyls, *Absorption, *Pikes, *Rivers, Path of pollutants, DDT, Dieldrin, Water pollution sources, Pesticides, Insecticides, Freshwater fish.
Identifiers: *River Avon(U.K.), *River Frome(U.K.).

Fish obtained from four sites on the River Avon and two sites on the River Frome, United Kingdon, were analyzed for PCB levels. Sampling occurred between October 1972 and January 1974. High levels of PCB's in the River Avon were first noted in June, 1973M and the source was probably a factory. PCB's are used commonly in the area. All species of fish from the River Avon contained various levels of PCB7s with highest levels being 29.4, 26.6 and 10.6 ppm of Aroclors 1260 and 1254 in the livers and visceral fat from bleak and pikes respectively. Organochlorine pesticides identified from surface water samples were BHC's, dieldrin, DDT and its metabolites in very small quantities. (Katz)
W77-05627

PROLONGED ORAL ADMINISTRATION OF METHYL MERCURY CHLORIDE TO RAINBOW TROUT (SALMO GAIRDNERI) FINGERLINGS,
Saskatchewan Univ., Saskatoon. Dept. of Veterinary Pathology.
G. Wobeser.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 11, p. 2015-2023, 1975. 3 fig., 1 tab., 25 ref.

Descriptors: *Toxicity, Fish physiology, *Mercury, *Rainbow trout, *Chlorinated hydrocarbon pesticides, Fish physiology, Salmonids, Distribution, Growth stages, Fry, Metabolism, Path of pollutants, Pesticide residues, Bioassay.
Identifiers: *Histology, *Morphology, Bioaccumulation, *Methyl mercury chloride, Tolerance, Loading.

Rainbow trout (Salmo gairdneri) fingerlings were fed rations containing 4, 8, 16, and 24 ppm mercury as methyl mercury chloride over a 105 day period. Fish receiving the 16- and 24-ppm rations had significantly higher blood packed cell volumes than did controls. Hyperplasia of the gill epithelia was the only morphologic alteration detected. Individual fish accumulated up to 30 ppm mercury in muscle tissue, but no mortality that could be attributed to mercury ocurred. Results suggested that trout can tolerate a large mercury burden if it is accumulated over a long time period. (Katz)
W77-05629

ACUTE TOXICITY OF METHYL MERCURY CHLORIDE AND MERCURIC CHLORIDE FOR RAINBOW TROUT (SALMO GAIRDNERI) FRY AND FINGERLINGS,
Saskatchewan Univ., Saskatoon. Dept. of Veterinary Pathology.
G. Wobeser.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 11, p. 2005-2013, 1975. 3 fig., 4 tab., 23 ref.

Descriptors: *Toxicity, *Mercury, *Rainbow trout, *Chlorinated hydrocarbon pesticides, *Salmonids, Fish physiology, Fry, *Lethal limit, Growth stages, Metabolism, Path of pollutants, Pesticide residues, Distribution.
Identifiers: *Histology, Bioaccumulation, *Methyl mercury chloride, *Mercuric chloride, *Epethilia, Fingerlings.

The median tolerance limit (MTL) for methyl mercury chloride at 24,48, and 96 h was 0.084, 0.05-5, and -.024 mg/liter as mercury, respectively,for fry; and 0.125, 0.066, and 0.042 mg/liter as mercury, respectively for fingerlings. The MTL (24 h) for mercuric chloride for fingerlings was 0.09 mg/liter as mercury. Fingerlings exposed to methyl mercury chloride concentrated mercury in their tissues much more reapidly than did those exposed to mercuric chloride. The acute action of both compounds was exerted kon the gills. Mercuric chloride caused severe epithelial necrosis. Poisoning by methy mercuric chloride was characterized by epithelial cell swelling and hyperplasia, a marked increase in the number of epithelial cells in mitosis, and terminal epithelial desquamation. (Katz)
W77-05630

NITRIFICATION IN AN AQUATIC RECIRCULATION SYSTEM,
Georgia Univ., Athens. Dept. of Medical Microbiology.
M. T. Collins, J. B. Gratzek, E. B. Shotts, Jr, and D. L. Dawe.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 11, p. 2025-2031, 1975, 5 fig., 29 ref.

Descriptors: *Nitrification, Model studies, *Channel catfish, *Water quality, Lethal limit, Toxicity, Bacteria, Mortality, Coliforms, Bioassay, Aquiculture, Laboratory tests, Hydrogen ion concecentration, Fresh water fish.
Identifiers: *Recirculating systems, Lactose fermentors, Aeromonads.

Water quality changes during establishment and maintenance of nitrification in four 70-liter recirculating systems each containing 20 channel catfish (Ictalurus punctatus) (total weight 150 g) were described. Establishment of nitrification took 33 days. During establishment of nitrification, all catfish in the systems died. Death appeared to be related to nitrite concentrations greater than 2.5 mg/liter NO2-N. The pH declined with progressive nitrification. When the pH was less than 6.0, nitrification ceased. Within 2 wk of introducing the catfish, total bacterial counts stabilized at 106 organisms per mililiter. Counts of lactose fermenters and aeromonads fluctuated aroun ^{4} 104 organisms per milliliter when fish were in the system and decreased markedly after the fish were removed. After establishing of nitrification, 40 channel catfish (total weight 100 g) were maintained successfully for 37 days. (Katz)
W77-05631

EFFECTS OF PARASITICIDES ON NITRIFICATION,
Georgia Univ., Athens. Dept. of Medical Microbiology.
M. T. Collins, J. B. Gratzek, D. L. Dawe, and T. G. Nemetz.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 11, p 2033-2037, 1975. 2 fig., 2 tab., 12 ref.

Descriptors: *Toxicity, *Nitrification, Ammonia, Nitrates, Model studies, Water quality, Catfishes, Dyes, Organic compounds, Toxicity, Copper sulfate, Potassium compounds, Sodium chloride.
Identifiers: *Parasiticides, *Recirculating systems, Methylene blue, Formalin, Malachite green, Potassi-m permanganate.

Treatment of four recirculating systems with a single dose of methylene blue at 5 mg/l resulted in complete cessation of nitrification for 16 days as evidenced by a rapid rise in ammonia and stable nitrate concentrations. The therapeutic use of methylene blue in recirculating systems was contraindicated. Treatment of the systems with therapeutic levels of formalin, malachite green, formalin and malachite green in combination, copper sulfate, potassium permanganate, and sodium chloride had no effect on nitrification. (Katz)
W77-05632

CHEMOSENSORY RESPONSE OF AMERICAN LOBSTERS (HOMARUS AMERICANUS) IN THE PRESENCE OF COPPER AND PHOSPHAMIDON,
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
D. W. McLeese.
Journal of the Fisheries Research Board of Canada, Vol. 32, No. 11, p. 2055-2-60, 1975. 4 tab., 23 ref.

Descriptors: *Lobsters, *Crustaceans, Animal physiology, *Copper, *Phosphorous compounds, Lethal limit, Pollutants, Toxicity, Pesticides, Bioassay, Path of pollutants, Animal behavior, Water quality.
Identifiers: *American lobster, *Phosphamidon, *Bioaccumulation, *Chemosensory response.

In test runways the chemosensory response of American lobsters (Homarus americanus) to herring muscle extract, applied for 3 minutes, was reduced by the simultaneous presentation of copper at concentrations estimated to be 4-80 times the lethal threshold. The reduction resulted from avoidance of copper. Simultaneous application of the extract and of phosphamidon at concentrations about 25-100 times the lethal threshold had no effect. Exposure up to 48 h to copper at concentrations 0.7-1.8 times the lethal threshold caused a gradual decline in chemosensory response of lobsters, followed by gradual recovery in clean water. Exposure up to 48 h to phosphamidon at concentrations of 0.7-1.8 times the lethal threshold had no effects on the response. (Katz)
W77-05633

BIOCONCENTRATION OF FOUR PURE PCB ISOMERS BY CHLORELLA PYRENOIDOSA,
Wheaton Coll., Norton, Mass. Dept. of Biology.
J. C. Urey, J. C. Kricher, and J. M. Boylan.

Bulletin of Environmental Contamination and Toxicology, Vol. 16, no. 1, p. 81-85. 1976. 3 tab, 4 ref.

Descriptors: *Absorption, *Chlorella, *Algae, *Polychlorinated biphenyls, *Growth rates, *Environmental effects, *Water pollution effects, *Aroclor, Laboratory tests, Pesticides, Chlorinated hydrocarbon pesticides, Lipids, Primary productivity.
Identifiers: *Bioaccumulation(PCB).

Chlorella was exposed to tetrachloro, hexachloro, octachloro and decachloro PCB isomers and was found to concentrate these PCB's by several thousand-fold, whether the cells were living or dea. The ability of the dead cells to concentrate PCB's suggests partitioning into cell lipids. No inhibition of growth of Chlorella by the PCB isomers was observed. In addition, Aroclor 1242 had no effect on growth and productivity of Chlorella. It appears that PCB's are relatively non-toxic to Chlorella although they are concentrated by the cells. (Katz)
W77-05634

EFFECTS OF ENVIRONMENTAL DISTURBANCE ON THE DISTRIBUTION AND PRIMARY PRODUCTION OF BENTHIC ALGAE ON A BRITISH COLUMBIA ESTUARY,
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.
W. M. Pomeroy, and J. G. Stockner.
Journal of the Fisheries Research Board of Canada, vol. 33, p. 1175-1187. 1976. 7 fig, 5 tab, 29 ref.

Descriptors: *Primary productivity, *Algae, *Salinity, *Turbidity, *Estuaries, *Environmental effects, *Benthic flora, *Distribution, Biomass, Habitats, Temperature, Water properties, Diatoms, Chlorophyta, On-site investigations, *Canada.
Identifiers: *Fucus.

Construction of a river training dyke resulted in strong salinity, water transparency, and sedimentation gradients, across the estuary face which have significantly affected the distribution and primary production of benthic algae. The estuary west of the dyke is now unsuitable for algae colonization and growth. During river freshet, heavy sedimentation and salinities less than 3‰ make algal survival difficult. A salinity range up to 25‰ is common over a tidal cycle. Algae in this area are generally strongly euryhaline and mean production is 0.6 gC per square meter per day. The eastern portion of the estuary has a more stable benthic environment. Lower sedimentation and higher salinity result in greater species diversity, biomass and primary production. Dominant species differ from those of the western part and include a variety of diatom communities. The algae are weakly euryhaline, with optimum salinities between 15 and 30‰. Mean production is 2.2gC per square meter per day. Recent intrusion of Fucus resiculosus indicates that the eastern estuary is developing into a more marine habitat. Annual production estimates of 215gC per square meter approximated for estuaries at similar latitudes. (Katz)
W77-05635

EVALUATION OF A TOXICANT ON THE METABOLISM OF MODEL STREAM COMMUNITIES,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
A. W. Maki, and H. E. Johnson.
Journal of the Fisheries Research Board of Canada. Vol 33, p. 2740-2746, 1976. 6 fig., 2 tab., 16 ref.

Descriptors: *Toxins, *Respiration, *Toxicity, *Model studies, *Benthos, Primary productivity, Chlorophyta, Biological communities, Ponds, Streams, Theoretical analysis, Photosynthesis, *Metabolism, Diatoms, Isopods, Diptera, Amphipoda, Stoneflies, Mayflies, Environmental effects.
Identifiers: *Lampricides, *TFM, *Bioaccumulation, Trichoptera.

The effects of lampricide TFM (3-trifluoromethyl-4-mitrophenol) on the metabolism of benthic communities were studied in a series of six model stream resembling typical woodland streams. A specially developed in situ respirometer was used for measurements of net primary production and community respiration in pool and riffle communities. Pretreatment levels of gross primary production ranged during summer, fall, and early winter from 10.7 to 79.0 mg 02 per square meters per hour and were suppressed by 25-50% during exposure to 9.0 mg/l TFM. Community respiration ranged from 10.5 to 36.2 mg 02 per square meters per hour during the same time period and was increased 3-50% by the 9.0 mg/l lampricide treatment. Calculated photosynthesis to respiration (P:R) ratios proved to be sensitive indicators of the influence of the toxicant. The stream communities demonstrated a capacity to adjust to the toxicant influence as evidenced by the rapid return to metabolic rates to pretreatment levels following the exposure period. (Katz)
W77-05637

ROLE OF MICROBIAL ENRICHED DETRITUS IN THE NUTRITION OF GAMMARUS MINUS (AMPHIPODA),
Chatham Coll., Pittsburgh, Pa. Dept. of Biology.
M. Kostalus, and R. L. Seymour.
Oikos, Vo. 27, No. 3, p. 512-516, 1976. 4 tab., 26 ref.

Descriptors: *Invertebrates, *Food chains, *Amphipoda, *Detritus, *Microorganisms, *Diets, *Nutrients, *Aquatic bacteria, *Aquatic fungi, Food habits, Crustaceans, Sediments, Laboratory tests, Leaves.
Identifiers: *Gammarus minus, *Feeding studies.

Microbial enriched detritus is an important food source for many stream invertebrates. Results of laboratory feeding experiments showed significant differences in survivorship of Gammarus minus say on 10 different diet combinations over a 10 week period. Highest survivorship was recorded on fungus enriched leaves; intermediate rates were obtained for leaves with a viable bacterial flora and leaves on which the microflora had been killed. Low survival rates were recorded on sterile leaves and leaves with reduced microflora. The results of food preference studies showed that leaves having a viable fungus flora were most preferred while sterile leaves were least preferred. Overall, Gammarus showed a preference for those diets affording the best survivorship in the feeding experiments. Evidence indicates that the nutrition of G. minus is based on a food chain of detritus and the associated fungi. (Katz)
W77-05638

TOXICITY OF THE INSECTICIDE METHOXYCHLOR TO THE DUNGENESS CRAB CANCER MAGISTER,
Oregon State Univ., Newport. Marine Science Center.
D. A. Armstrong, D. V. Buchanan, M. H. Mallon, R. S. Caldwell, and R. E. Millemann.
Marine Biology, Vol. 38, p. 239-252, 1976. 9 fig., 6 tab., 26 ref.

Descriptors: *Insecticides, *Crabs, *Crustaceans, *Toxicity, *Pesticides, *Chlorinated hydrocarbon pesticides, *Growth stages, Path of pollutants, Mortality, Environmental effects, Animal physiology, Lethal limit, Bioassay, Metabolism, Larvae, Juvenile growth stage, Mature growth stage.
Identifiers: *Methoxychlor, *Dungeness crab, Histology, Ecdysis, Bioaccumulation.

The toxicity of methoxychlor, determined in acute and chronic studies using larval, juvenile, and adult stages of Dungeness Crab, Cancer magister, was inversely related to the age of the crabs after hatching and increased with the length of exposure. Hatching of eggs was not adversely affected by methoxychlor concentrations up to 10 micrograms/liter, and molting from prezoeae to zoeae was reduced 30% from controls. Sensitivity of adult and juvenile crabs increased during ecdysis. In uptake experiments, juvenile crabs concentrated methoxychlor more rapidly than did adults. Loss of the pesticide from adult crabs was rapid, and was 95% complete after 15 days of depuration. Concentrations of methoxychlor were found to be highest in exoskeleton, gill, and hepatopancreatic tissues, in declining order. About 81% of the methoxychlor measured in whole body samples was associated with exoskeleton. (Katz)
W77-05639

EFFECTS OF VARIOUS ENVIRONMENTAL FACTORS ON EGG DEVELOPMENT OF SEVERAL SPECIES OF ACARTIA IN SOUTHERN CALIFORNIA,
Scripps Institution of Oceanography, La Jolla, Calif.
S. Uye, and A. Fleminger.
Marine Biology, Vol. 38, p. 253-262. 1976. 5 fig., 1 tab., 23 ref.

Descriptors: *Copepods, *Plankton, Invertebrates, *Life stages, *Embryonic growth stages, Growth rates, *California, *Environmental effects, Water quality, *Salinity, Temperature, Oxygen, Light intensity, Benthos, Mud, Sediments, Water temperature.
Identifiers: *Acartia, Survival.

The hatching of the eggs of 3 Acartia species (A. tonsa, A. Clausi, and Acartia sp. I) spawned in the laboratory and the eggs of Acartia (species undetermined) isolated from natural bottom sediments was examined under various environmental conditions (temperature, salinity and temperature combinations, oxygen concentration, illumination, and the presence of bottom mud). The range of temperature and salinity in which eggs hatched differed from one species to another. Egg hatching was inhibited under ceratin environmental conditions for all species, althoigh egg viability under such conditions varied from one species to another. In relation to these findings, habitat separation of planktonic Acartia populations and the role of dormant eggs during their seasonal absence in the plankton of Southern California coastal waters were discussed. (Katz)
W77-05640

TOXIC EFFECTS OF HEXAVALENT CHROMIUM ON BROOK TROUT (SALVELINUS FONTINALIS) AND RAINBOW TROUT (SALMO GAIRDNERI),
Environmental Research Lab., Duluth, Minn.
D. A. Benoit.
Water Research, Vol. 10, p. 497-500, 1976, 2 fig., 2 tab., 11 ref.

Descriptors: *Heavy metals, *Chromium, *Salmonids, *Bioassay, *Toxins, *Toxicity, *Rainbow trout, *Brook trout, *Trout, *Growth rates, Growth stages, Life cycles, Reproduction, Productivity Bioindicators, Lethal limit, Mortality, Environmental effects, Water quality, Path of pollutants, Fish eggs, Fish physiology.
Identifiers: Bioaccumulation, *Survival rates.

Exposing brook trout to various concentrations of chromium for up to 22 months including reproduction significantly increased alevin mortality at 0.35mgCr/1 and retarded growth of young brook trout at the lowest concentation testes (0.01mg Cr/l.). Eight month exposures of rainbow trout significantly increased alevin mortality at 0.34mg Cr/1 and also retarded growth at the lowest concentration tested. Exposure of brook trout lasting

22 months showed that growth was only temperarily affected. Reproduction and embryo hatchability of trout were unaffected at Cr concentrations that affected survival of newly hatched alevins. The maximum acceptable toxicant concentration (MATC) for brook and rainbow trout exposed to Cr in water with a hardness of 45mg/1 (as CaCo3) and a pH range of 7-8 lay between 0.20-0.35mg Cr/1. the 96-h LC-50 for brook and rainbow trout was 59 and 69 mg Cr/1, respectively; the application factor (MATC 96-h L-50) for both species was determined to lie between 0.003 and 0.006. (Katz)
W77-05641

VARIATIONS IN THE HEPATOPANCREATIC A-AMYLASE ACTIVITY IN FISHES EXPOSED TO SOME INDUSTRIAL POLLUTANTS,
Visva-Bharati Univ., Santiniketan (India).
S. Mukherjee, and S. Bhattacharya.
Water Research, Vol. 11, p. 71-74, 1977, 3 fig, 2 tab, 14 ref.

Descriptors: *Freshwater fish, *Inhibition, *Enzymes, *Fish physiology, *Effluents, *Toxins, *Pollutants, *Industrial wastes, Water pollution sources, Water quality, Phenols, Copper, Ammonia, Sulfides, Bioassay, Analytical techniques, Mode of Action, Metabolism.
Identifiers: *Hepatopancreatic alpha-amylase, Bioaccumulation, *Ophicephalus punctatus, *Clarias batrachus.

The effect of industrial pollutants on the hepatopancreatic alpha-amylase activity in two freshwater teleosts Ophicephalus punctatus and Clarias batrachus were investigated. High degrees of inhibition were noted in isolated treatments with the toxicants and composite factory effluent. Although the concentrations of the pollutants used showed similar survival rates, they differed significantly in the extent of their action. Low concentrations producing only a 10% mortality rate were no less physiologically effective than the TL-50 doses. 90 days chronic exposure to the undiluted factory effluent caused no mortality, but produced a high degree of inhibition. The toxicants tested were phenols, sulfides, copper and ammonia.
W77-05642

BARRIER FUNCTION OF WATERPIPE INSTALLATIONS, (IN RUSSIAN),
For primary bibliographic entry see Field 5D.
W77-05643

A LABORATORY MODEL FOR EVALUATING THE BEHAVIOR OF HEAVY METALS IN AN AQUATIC ENVIRONMENT,
Eastman Kodak Co., Rochester, N. Y. Health and Safety Lab.
C. J. Terhaar, W. S. Ewell, S. P. Oziuba, W. W. White, and P. J. Murphy.
Water Research, Vol. 11, p. 101-110, 1977, 3 fig, 11 tab, 12 ref.

Descriptors: *Model studies, Research and development, *Heavy metals, *Bioindicators, *Water quality, *Silver, *Mercury, *Algae, *Mussels, *Minnows, Path of pollutants, Bioassay, Pollutant identification.
Identifiers: Bioaccumulation, Biomagnification, Dynamic biological systems, Pimephales promelas, Thiosulfates, Scenedesmus sp., Margaritifers sp., Liqumia sp., Daphnia magna.

A dynamic biological system capable of simultaneously distinguishing between bioaccumulation and biomagnification through successive trophic levels in an aquatic ecosystem was described. The organisms used in the system were algae, Scenedesmus sp., Daphnia magna, freshwater mussels, Liqumia sp. and Marqaritifera sp., and the flathead minnow, Pimephales promelas. Thiosulfate complexed mercury and silver were each studied at two concentrations. The water and organisms were analysed for the metals periodically during the 10-week tests. Both mercury and silver were bioaccumulated by fish. The concentration factors for mercury were greatr than for silver. Further, mercury was biomagnified by fish whereas silver was not. Freshwater mussels were found to be poor indicator species for metal contamination. (Katz)
W77-05644

STUDIES ON THE TOXICITY OF COPPER SULPHATE TO STONE LOACH NOEMACHEILUS BARBATULUS (L.) IN HARD WATER,
Water Pollution Research Lab., Stevenage (England).
J. F. de L. G. Solbe, and V. A. Cooper.
Water Research, Vol. 10, p 523-527, 1976, 3 fig, 5 tab, 14 ref.

Descriptors: *Toxins, *Toxicity, *Fish physiology, *Copper, *Copper compounds, *Copper sulfate, *Hardness(Water), Water quality, Path of pollutants, Mode of action, Salmonids, Rainbow trout, Bioassay, Metabolism, Lethal limit, Heavy metals, Cadmium, Zinc.
Identifiers: Bioaccumulation, *Stone loach, *Noemacheilus barbatulus, Survival rates, Site of action, Sensitivity.

The toxicity of copper sulphate to Neomacheilus barbatulus was studied for 64 days in a water of total hardness 249mg/1 at CaCO3. The 63-day LC-50 as 0.25mg Cu/1. Larger fish survived longer and at concentrations greater than 0.29mg/1 fish hid less during daylight. Noemacheilus surviving 0.12mg Cu/1 for 64 days shed copper when placed in clean water for 7 days. Gill, muscle, eye, and vertebre lost significant amounts of copper during this period. The opportunity to shed copper during a short period when the poison supply to their tank failed, may have allowed fish exposed to 0.49mg/1 to live 12 days longer than expected. The sensitivity of Noemacheilis to copper, cadmium, and zinc was compared to that of rainbow trout, salmo gairdneri. (Katz)
W77-05645

OBSERVATIONS ON THE TOLERANCE OF THE ISOPOD ASELLUS MERIDIANUS RAC. TO COPPER AND LEAD,
Cambridge Univ. (England). Dept. of Applied Biology.
B. E. Brown.
Water Research, Vol. 10, p. 555-559, 1976. 3 fig, 5 tab, 23 ref.

Descriptors: *Isopods, *Toxicity, *Toxins, *Heavy metals, *Lead, *Copper, *Growth rates, *Mine wastes, Invertebrates, Environmental effects, Water pollution sources, Water quality, Genetics, Laboratory tests, Fish physiology.
Identifiers: Bioaccumulation, Tolerance to metals.

Assellus meridianus from sites receiving mine-drainage in the Hayle and Gannel Rivers in Cornwall exhibited, by toxicity tests and growth rate experiments, to be particularly tolerant to copper and lead. Isopods from the Hayle, a river high in concentrations of copper in both water and sediments and low lead concentrations, were tolerant to both copper and lead. Isopods from the Gannel, a river with moderately high concentrations of copper and exceptionally high concentrations of lead, were tolerant to lead only. Tolerance to lead was shown to persist in animals from the Gannel F2 generation which had been cultured in the laboratory. (Katz)
W77-05646

BENTHIC FAUNAL DYNAMICS DURING SUCCESSION FOLLOWING POLLUTION ABATEMENT IN A SWEDISH ESTUARY,
Sweden Water and Air Pollution Research Lab., Goteborg.
R. Rosenberg.
Oikos, Vol. 27, No. 3, p. 414-427, 1976. 1 tab., 15 fig., 41 ref.

Descriptors: *Pollution abatement, *Succession, *Biological communities, *Benthos, *Analytical techniques, *Environmental effects, *Salinity, *Water temperature, Estuaries, Biomass, Water pollution effects, Invertebrates, Mollusks, *Pulp wastes.

Following the closure of a sulphite pulp mill the recovery and succession of the macrobenthic communities was monitored. Community composition similar to that recorded forty years before was achieved within eight years. The sequential changes of some numerically dominant populations showed a bell-shaped curve pattern. During the first years after pollution abatement, when polychaetes dominated, population changes were drastic but evened out in later seral stages. The role of larval recruitment in succession is discussed. Three diversity indices were used to assess the community structure: Shannon's formula, its measurement of evenness, and Sanders' rarefaction technique. As tools for assessing pollution or recovery, the two former had to be used with care, as the highest values were recorded at the beginning of the recovery process when the individuals found were few but evenly distributed among the few species present. The rarefaction technique and the measure of species richness were more satisfactory for this kind of assessment. (Katz)
W77-05647

RESIDUES OF ORGANOCHLORINE INSECTICIDES IN SOME FISHES AND BIRDS IN THE GEZIRA OF SUDAN,
Agriculture Research Corp., Wad Medani (Sudan).
G. A. El-Zorgani.
Pesticide Science, Vol 7, p. 150-152, 1976. 2 tab, 5 ref.

Descriptors: *Pesticides, *Birds, *Fish, *DDT, *DDE, *Dieldrin, *Path of pollutants, Animal physiology, *Chlorinated hydrocarbon pesticides, Metabolism, Laboratory tests, Bioassay, Africa, *Insecticides.
Identifiers: *TDE, Bioaccumulation, *Sudan(Gezira).

Twenty-eight specimens representing five species of fish and five species of birds from the Gezira Research Farm, Wad Medani, Sudan, were analyzed for residues of organochlorine insecticides. All fish muscle samples were found to contain DDE, TDE, and DDT in total concentrations ranging from 0.27 to 16.0 mg/kg tissue. In addition to DDT-type residues, dieldrin was also found in bird samples. Concentrations in bird breast muscle ranged from 0.07 to 5.5 mg/kg. Bird liver samples examined were found to contain higher residue levels than the breast muscle samples. (Katz)
W77-05648

DDT RESIDUES IN BENTHIC INVERTEBRATES AND DEMERSAL FISH IN ST. MARGARET'S BAY, NOVA SCOTIA,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
B. T. Hargrave, and G. A. Phillips.
Journal of the Fisheries Research Board of Canada, Vol 33, p. 1692-1698, 1 fig, 1 tab, 21 ref.

Descriptors: *Pesticides, *DDT, *Chlorinated hydrocarbon pesticides, *Path of pollutants, *Food chains, *Food webs, *Bottom fish, DDE, DDD, Metabolism, Invertebrates, Fish, Animal physiology, Amphipoda, Gastropods, Laboratory tests, Detritus, Air environment, Benthos, *Canada.
Identifiers: Bioaccumulation, *Demersal fish, St. Margaret's Bay(Nova Scotia).

Organochlorine residues, DDT and its metabolites, were measured in samples of benthic

invertebrates and demersal fish taken from St. Margaret's Bay, Nova Scotia. No other organochlorine compounds were present in detectable amounts. Total DDT levels in whole organisms, excluding lipid-rich tissues, grouped as benthic epifauna, infauna, and demersal fish were not significantly different and thus no accumulation occurred in this food chain. Atmospheric supply was considered the most probably major source of low levels of contamination. A detritus-based food web was suggested as equalizing residue concentration between various feeding types. (Katz)
W77-05649

INFLUENCE OF TEMPERATURE AND WIND ON THE SURVIVAL OF EARLY STAGES OF YELLOW PERCH, PERCA FLAVESCENS,
Cornell Univ., Ithaca, N. Y. Dept. of Natural Resources.
M. D. Clady.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 1887-1893, 1976, 4 fig, 3 tab, 15 ref.

Descriptors: *Yellow perch, *Perches, *Growth stages, *Life cycles, *Fish eggs, *Embryonic growth stage, *Larvae, *Fecundity, *Winds, *Air circulation, *Air temperature, *Air environment, *Fish physiology, Environmental effects, Bioassay, Turbulence, Weather.
Identifiers: *Survival rates.

Survival from the egg to larval stage was estimated for the 1969-75 year-classes of yellow perch, Perca flavescens, in Oneida Lake. Egg production was determined from mark-and-recapture estimates of adult stock and measurements of fecundity, and abundance of the resulting cohort was estimated from annual larval surveys. Early survival, which varied from 1.6 to 18.4% was correlated positively with temperature and negatively with wind. Two variables, mean daily air temperature during the 3 wk prior to the date the larvae attained a mean length of 8mm and mean daily wind velocity for 4 wk prior to this date, accounted for 87% of the variability in survival of perch. Physical destruction and movement of eggs by high winds and greater mortality of prolarvae caused by low temperature could account for the differences in survival between years, but do not appear severe enough to account for the 80+% base mortality that occurred in all years. The low year-to-year variation in survial suggests that temperature and wind influenced year-class size through a complex of many relatively minor mortality factors, rather than through one catastrophic event. (Katz)
W77-05650

THE TOXIC EFFECTS OF TRINITROTOLUENE (TNT) AND ITS PRIMARY DEGRADATION PRODUCTS ON TWO SPECIES OF ALGAE AND THE FATHEAD MINNOW,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
L. A. Smock.
Water Research, Vol. 10, p. 537-543, 1976, 8 fig, 24 ref.

Descriptors: *Toxicity, *Toxins, *Metabolism, *Algae, *Minnows, *Chemical reactions, *Chemical wastes, Bioassay, Inhibition, Growth rates, Animal behavior, Mortality, Lethal limit.
Identifiers: *Fathead minnows, *Ammunition wastes, *TNT, *Trinitrotoluene, *Microcystis aeruginosa, *Selenastrum capricornutum, *Pimephales promelas, *TNTcc, *Bioaccumulation.

The effects of alpha trinitrotoluene (alpha TNT) and its primary degradation product (TNTcc), commonly referred to as 'pink water', were determined on members of two trophic levels. The growth responses of the algae Selenastrum capricornutum and Microcystis aeruginosa were examined through static bioassays, Death and behavioral responses of the fathead minnow (Pimephales promelas) were determined using a proportional diluter. Alpha TNT and TNTcc were both more toxic to the fathead minnow than to either species of alga. Five and 15mg/l alpha TNT inhibited S. capricornutum and M. aeruginosa growth, respectively.. TNTcc inhibited S. capricornutum growth at concentrations above 9 mg/1: it was lethal to M. aeraginosa to 50mg/l, but stimulated growth at lower concentrations. The 96-h LC-50 values based on the death response of the fathead minnow to alpha TNT and TNTcc were 2.58 and 1.60mg/l, respectively. The 96-h LC-50 values based on the behavioral responses were 0.46 and 0.64mg/l, respectively. There was no response to concentrations of 0.05mg/l and aplha TNT and 0.07mg/l TNTcc. (Katz)
W77-05651

STUDY OF A HUMAN POPULATION EXPOSED TO METHYLMERCURY FROM FISH CONSUMPTION, (IN FRENCH),
Siena Univ. (Italy). Laboratorio di Idrobiologio.
E. Bacci, G. Angotzi, A. Bralia, L. Lampariello, and E. Zanette.
Rev Int Oceanogr Med 41/42, p 127-141, 1976.

Descriptors: *Mercury, Human population, Fish, Distribution, *Food chains, Toxicity, Pollutant identification.
Identifiers: *Vada(Italy), *Methylmercury.

This research concludes a study on Hg distribution along the foodchains in a particular environment, the shallow waters of Vada (Leghorn, Italy), polluted by the discharge of a chlor-alkali plant. Humans, the last step of the food-chain, were studied by means of the most accessible biological samples (blood, urine, nails, and hair). The results obtained are considerably more than the norm and strictly dependent on the consumption of local fish. The correlation between concentrations of Hg in the biological parameters and their variation during a period of time was also studied. Since the Hg is found almost completely in the form of methylmercury, all the persons were examined from a neurological point of view. None of them, for the moment, present evident symptoms of an acute intoxication by methylmercury, but subclinical damage is not to be excluded.--Copyright 1976, Biological Abstracts, Inc.
W77-05688

EFFECTS OF KRAFT PULPING EFFLUENTS ON THE BENTHIC ALGAL POPULATIONS IN NORTHWESTERN SPAIN. I. DISTRIBUTION AND ABUNDANCE OF CHARACTERISTIC FUCACEAE (INCIDENCIA DE VERTIDOS INDUSTRIALES EN LA ESTRUCTURA DE POBLACIONES INTERMAREALES. I. DISTRIBUCION Y ABUNDANCIA DE FUCACEAS CARACTERISTICAS),
Instituto de Investigaciones Pesqueras, Vigo (Spain).
F. X. Niell, and Y. J. Buela.
Investigacion Pesquera, Vol 40, No 1, p 137-149, January, 1976. 5 fig, 6 ref, 2 tab.

Descriptors: *Pulp wastes, *Water pollution effects, *Benthic flora, *Aquatic algae, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Aquatic microorganisms, Lignins, Biomass, Europe, Foreign countries, Bays.
Identifiers: *Spain, Pontevedra Bay(Spain), Fucaceae.

Populations of intertidal Fucaceae growing near kraft pulp mill discharges in Pontevedra Bay in Northwestern Spain show signs of stress as a result of the pollution. Measurement of stress on populations of Ascophyllum nodosum, Pelvetia canalicalata, Fucus vesiculosus, and Fucus spiralis is discussed. A high correlation was noted between quantities of lignosulfonic residues and biomass. (Sykes-IPC)
W77-05690

FISH TOXICITY WITH SPECIFIC REFERENCE TO THE PULP AND PAPER INDUSTRY,
R. J. P. Brouzes.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 81-124, March, 1976. 3 fig, 105 ref, 8 tab, 3 append.

Descriptors: *Pulp wastes, *Fish, *Toxicity, *Water pollution effects, Aquatic animals, Bioassay, Water pollution sources, Wastes, Industrial wastes, *Pulp and paper industry, Effluents, Water pollution.
Identifiers: Technical nomenclature.

This discussion outlines basic toxicity (acute and sublethal) concepts, fish bioassay techniques, and sources and characteristics of pulp and paper mill-derived pollutants which are deleterious to aquatic organisms. A glossary of terms is appended. (See also W77-05708) (Brown-IPC)
W77-05712

PHYSIOLOGICAL EFFECTS OF CERTAIN ENVIRONMENTAL FACTORS ON ORGANIC METABOLISM IN FISH, (IN FRENCH),
Ann Inst Michel Pacha 7, p 41-71, 1974.

Descriptors: *Metabolism, *Temperature, *Salinity, *Carbohydrates, *Lipids, *Proteins, Fish, Industrial wastes, Mortality, *Oxygenation.

The influences of oxygenation, tempeature and salinity on carbohydrate, lipid and protein metabolism in fish were analyzed. Studies on the effects of variations in any of these factors, due to natural events or industrial pollution, on development and survival of populations of numerous species were reviewed.--Copyright 1976, Biological Abstracts, Inc.
W77-05719

POST-IMPOUNDMENT EFFECTS OF REGULATED FLOWS FROM DWORSHAK DAM ON THE BENTHIC INSECT COMMUNITY OF THE CLEARWATER RIVER, IDAHO,
Idaho Univ., Moscow. Dept. of Entomology.
J. E. Stanton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 883, Price codes: A05 in paper copy, A01 in microfiche. M. S. Thesis, January 1977. 80 p, 11 fig, 13 tab, 38 ref, 3 append. OWRT A-035-IDA(4). 14-34-0001-7028.

Descriptors: *Benthos, *Aquatic insects, Diptera, Mayflies, Caddisflies, Aquatic habitats, *Post-impoundments, Sites, Shores, Aquatic environment, Aquatic drift, *Idaho, Rivers, Dams, *Regulated flow.
Identifiers: Riffles, Pools, *Clearwater River(Idaho), Dworshak Dam(Idaho), Colonization.

A study of determine post-impoundment effects of Dworshak Dam on aquatic insects in northern Idaho's Clearwater River was conducted from August 1973 to September 1976. Shoreline riffles and pools were sampled and laboratory and instream simulation tests conducted to study habitat preference and colonization behavior. Dworshak Dam has had little appreciable effect on yearly maximum and minimum flows and river temperatures. Deterimental effects on river benthos have been small. Decreases in insect density have occurred on shoreline substrate that is subjected to daily dewatering because drifting insects do not readily colonize these areas. Under natural conditions, colonization time was more important than

periphyton development in determining insect density on cobble substrate. Two to three weeks were required for colonization by most species to be statistically equal on newly-watered and permanently-watered substrates. Insect density in shoreline riffles increased with increasing depth to 45 cm even under stable flow conditions. Drift studies near shore revealed that most insects were night active and that, while the highest total number per hour drifted at the 45 cm depth, the largest number per m3 of flow drifted at the 15 cm depth. A larger percentage of the insect community drifted at the shallower depth, thus supporting the idea that habitat quality for many riverine species is less near the water's edge even under natural flow conditions.
W77-05725

THE GROWTH OF DAPHNIA MAGNA IN A MEDIUM ENRICHED WITH DISSOLVED ORGANIC SUBSTANCES, (IN RUSSIAN),
Belorussian State Univ., Minsk (USSR).
N. M. Kryuchkova, and V. K. Rybak.
Gidrobiol Zh 12(2), p 62-66, 1976.

Descriptors: *Algae, Daphnia, *Organic matter, Dissolved solid, Reproduction, *Growth rates.
Identifiers: *Daphnia-magna, *Dissolved organic matter, *Algal hydrolystate.

The growth of sterile D. magna cultures in media enriched with dissolved organic substances in the form of aminopeptide, or algal hydrolystate as the only food source was stuidied. Algal hydrolysate in a concentration of 7 cal/l maintained life and somatic growth of the water fleas for a long period of time (20-18 days), but did not ensure reproduction.--Copyright 1976, Biological Abstracts, Inc.
W77-05727

THE EFFECT OF SELENIUM ON THE ULTRASTRUCTURE AND PHYSIOLOGICAL PROPERTIES OF THE BLUE-GREEN ALGA, PHORMIDIUM LURIDUM VAR. OLIVACEA,
Toledo Univ., Ohio. Dept. of Biology.
M. Sielick.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 066, Price codes: A08 in paper copy, A01 in microfiche. M. S. Thesis, May 1972. 156 p, 46 fig, 6 tab, 59 ref. OWRT A-025-OHIO(2).

Descriptors: *Cyanophyta, Phytoplankton, Toxicity, *Growth rates, Lethal limit, Photosynthesis, Algae, Cytological studies, Inhibitors, Monitoring.
Identifiers: *Selenite, *Phormidium luridum, *Selenium, Lysis, Ultrastructive(Algae).

The experiments were employed to monitor Blue-green algae growth. It was determined that the threshold level was between 10-6M selenite. At the 10-6M concentrations, no apparent adverse response was noted in P. luridum. However, at concentrations of 10-5M the alga degenerated in a progressive sequence which terminated in lysis. All selenite concentrations except 10-6M induced an immediate (within 6 hours) inhibitory effect on photosynthetic activity. The ultrastructural observations of selenite treated P. luridum cells appears to be indicative of aging and degnerating cells, i.e., granular cytoplasm, numerous storage vacuoles and cellular inclusions, intacellular spaces, protoplast formation, eventual lysis and release of cell contents. The investigation showed that selenium (in the form of selenite ion) is toxic and lethal to P. luridum in concentrations exceeding 10-6M. (Chao-Ohio State).
W77-05729

THE AGE AND GROWTH OF THE LARGEMOUTH BASS MICROPTERUS SALMOIDES (LACEPEDE), IN A THERMALLY LOADED RESERVOIR,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
G. P. Busacken.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 914, Price codes: A07 in paper copy, A01 in microfiche. M.A. Thesis, August 1971. 102 p, 12 fig, 13 tab, 54 ref, 3 append. OWRT B-039-MO(2), 14-31-0001-3296.

Descriptors: *Thermal pollution, Reservoirs, Fisheries, *Age, *Growth rates, *Bass, Heated water, *Missouri, Water pollution effects, Electric powerplants.
Identifiers: Thomas Hill Reservoir(Mo).

The age and growth of largemouth bass was studied in a thermally loaded 4,500 acre-reservoir. Growth of fish from the Hotwater Arm was compared to that from a Control Arm. Maximum discharge temperature was 37C which elevated the Hotwater Arm 0.5-11.5C above the Control Arm. The reservoir was formed in 1966, clear for 3 years, but became turbid in '69-'70, the time of the study. Heated water had no effect on water quality. Checks formed on the scales in winter and summer which made age and growth analysis difficult. No differences were found between body-scale relationships or condition factors. Heated water had these measurable effects upon the bass: (1) annulus formation occurred one month earlier; (2) it extended the growing season and annual increment of growth; (3) bass were attracted to heated water and provided an excellent winter fishery. Heated water had no apparent deleterious effects on largemouth bass. (Witt-Missouri)
W77-05731

GROWTH OF THE WHITE CRAPPIE ON A RESERVOIR RECEIVING A THERMAL DISCHARGE: THOMAS HILL, MISSOURI,
Missouri Univ.-Columbia. School of Forestry, Fisheries and Wildlife.
N. Siripunt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 154, Price codes: A08 in paper copy, A01 in microfiche. M.A. Thesis, December 1972. 127 p, 27 fig, 10 tab, 110 ref. OWRT B-039-MO(3), 14-31-0001-3296.

Descriptors: *Thermal pollution, Reservoirs, Fisheries, Age, *Growth rates, *Sunfishes, *Missouri, Heated water, Water pollution effects, Electric powerplants.
Identifiers: Thomas Hill Reservoir(Mo), *White crappie.

The age and growth of white crappie was studied in a thermally loaded 4,500 acre reservoir. Growth of fish from the Hotwater Arm was compared to that from a Control Arm. Maximum discharge temperature was 37C which elevated the Hotwater Arm 0.5-11.5C above the Control Arm. The reservoir was formed in 1966, clear for three years, but became turbid in '69-'70, the time of this study. After a detailed analysis of 2,454 fish it is difficult to state categorically what effect heated water had on the growth rate. Of note is that a 'normal' frequency distribution of fish was composed of 2 to 4 classes. Young fish of several year classes grew to 140-160 mm and then stopped growing. Turbidity and available forage may have been determinant factors in growth of this fish population. (Witt-Missouri)
W77-05732

THE ENVIRONMENT OF SOUTH FLORIDA, A SUMMARY REPORT,
Geological Survey, Miami, Fla. Water Resources Div.
For primary bibliographic entry see Field 6G.
W77-05738

GAS BUBBLE DISEASE IN THE BLUE CRAB, CALLINECTES SAPIDUS,
National Marine Fisheries Service, Oxford, Md. Pathobiology Investigations Lab.
P. T. Johnson.
Journal of Invertebrate Pathology, Vol. 27, 1976, p. 247-253. 12 fig, 2 tab, 8 ref.

Descriptors: Commercial shellfish, *Crabs, Crustaceans, *Supersaturation, *Animal diseases, Animal physiology, *Animal pathology, Bioassay, Mortality, Laboratory investigations, Seawater, Animal parasites, Benthos.
Identifiers: *Blue crab, Callinectes sapidus, *Gas emboli, Crab gills, Heart, Crab tissues, *Gas bubble disease, Paramebiasis.

Exposure of crabs to water supersaturated with air resulted in formation of gas embolism in the hemal system, which in turn caused localized ischemia. More than one-third of the exposed crabs died during the 2 days following the episode. In surviving crabs, the most severely affected organs and tissues were the gills, heart, and antennal gland. Especially in gills, emboli were still present in apparently healthy crabs 35 days following exposure to water supersaturated with air. Evidence of ischemic injury was focal in character except in the antennnal gland, where the epithelium of the labyrinth was sometimes extensively degenerate. Repair processes apparently did not involve hemocytes except for occasional fibroblastic infiltration in damaged gill lamellae. (Katzd)
W77-05763

DISSOLVED GAS MONITORING AT GRAND COULEE DAM AND LAKE ROOSEVELT,
Seattle Marine Labs., Seattle, Wash.
For primary bibliographic entry see Field 5B.
W77-05764

HYDROLOGICAL PARAMETERS AND GAS BUBBLE DISEASE IN A MARICULTURE POND AND FLOW THROUGH AQUARIA RECEIVING HEATED EFFLUENT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
N. C. Parker, K. Strawn, and T. Kaehler.
(1976), 29 p., 2 tab., 7 fig., 22 ref.

Descriptors: *Atmospheric gas, Dissolved oxygen, Hydrogen ion concentration, Nitrogen, *Supersaturation, *Aquaculture, *Water temperature, Water quality, Sea water, Thermoelectric power, On-site data collections, *Monitoring, *Marine fish, Estuarine fish, Shrimp, Ponds, Industrial wastes, Turbidity, Seasonal, *Thermal pollution.
Identifiers: Flow-through aquaria, *Total dissolved gas, *Gas bubble disease, *Mariculture, Grass shrimp, Supersaturation.

Total dissolved gas, dissolved oxygen, dissolved nitrogen, pH, conductivity, temperature, and turbidity were monitored to determine diel and annual changes in a mariculture pond and in aquaria supplied with water discharged from a power plant. The diel and annual ranges of all hydrological parameters were greater in the pond than in aquaria. Diel patterns were similar in both cases but the amplitude was attenuated in the laboratory aquaria. Gas bubble disease (GBD) developed in 17 marine and estuarine fishes and in grass shrimps in the laboratory. GBD was more prevalent in aquaria at higher temperatures than in aquaria at lower temperatures. The disease occurred only in the winter months and was simultaneously found in fish in aquaria and in fish cultured in cages in the discharge canal. GBD was attributed to nitrogen supersaturation produced as water passed through the power plant and also to pump cavitation and to changing fish from water of high saturation to water of low saturation during cleaning of tanks. (Katz)
W77-05765

MORPHOLOGY AND FUNCTION OF THE LATERAL LINE OF JUVENILE STEELHEAD TROUT IN RELATION TO GAS BUBBLE DISEASE,
National Marine Fisheries Service, Seattle, Wash.

D. D. Weber, and M. H. Schiewe.
Journal of Fishery Biology, Vol. 9, 1976, p. 217-233, 13 fig., 63 ref.

Descriptors: *Rainbow trout, *Fish physiology, *Fish behavior, Animal pathology, Fish diseases, Laboratory tests, *Methodology, Nitrogen, Supersaturation, Juvenile fish.
Identifiers: *Gas bubble disease, *Fish morphology, *Lateral line function, *Lateral line morphology, Juvenile steelhead, *Electrophysiological monitoring, Gas emboli, Trunk lateral line, Stressed fish, Sensory loss, Sublethal effects, Lateral line sensory system.

General morphology of the lateral line of juvenile steelhead trout, Salmo gairdneri, is described. Through electrophysiological monitoring of individual nerve fibres, control patterns for spontaneous activity and reaction to sensory receptor stimulation were established. Spontaneous activity has a positive correlation with temperature and number of receptors innervated. Presence of directional sensitivity and response to near field water displacement at different frequencies is similar to that found in other fishes and amphibians. Normal lateral line response to a standardized set of stimuli was compared with the response of fish affected by gas-bubble disease. Results show that gas emboli formed in the scale pockets of the trunk lateral line of stressed fish, the ability to respond to stimuli was either diminished or completely disappeared. Further testing demonstrated that this sensory loss was reversible and that upon return to equilibrated water gas emboli disappeared and normal function was regained. This sublethal effect of gas-bubble disease on the lateral line sensory system may be an important element contributing to indirect mortality. (Katz)
W77-05766

SURVIVAL OF DAPHNIA, CRAYFISH AND STONEFLIES IN AIR-SUPERSATURATED WATER,
Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
A. V. Nebeker.
Journal of the Fisheries Research Board of Canada, Vol. 33 1976, p. 1208-1212. 2 fig, 3 tab, 18 ref.

Descriptors: Bioassay, *Mortality, *Supersaturation, Atmospheric gas, *Crustaceans, Freshwater benthos, *Daphnia, *Crayfish, *Stoneflies, Laboratory tests, *Animal physiology, *Water pollution effects, Lethal limit.
Identifiers: Daphnia magna, Pacifastacus, Acroneuria, Californica, *Lethal concentration, LC50, *Gas bubble disease, *Nitrogen supersaturation.

Daphnia magna, the crayfish Pacifastacus leniusculus, and nymphs of the stoneflies, Acroneuria californica, A. pacifica, and Pteronarcys californica, were tested in the laboratory to determine their survival in different concentrations of air-supersaturated water. The mean 96-h LC50 value (lethal concentration 50% mortality) for D. magna was 122.5% of total air saturation. The 7-day LC50 was 120% and the 10-day LC50 was 117.5%. The mean 96-h LC50 for crayfish was 147% total air saturation. The 7-day LC50 was 145% and the 10-day LC50 was 133%. The 10-day EC50 values (effective concentration, 50% immobilized) for stoneflies were 135% for A. californica, and greater than 125% for A. pacifica and P. californica. Bubbles (emboli) were observed in body fluids and tissues, and general body distention occurred before death in Daphnia, crayfish, and stoneflies. Lethal threshold concentrations for Daphnia and crayfish were near 111 and 127% respectively. (Katz)
W77-05767

NITROGEN SUPERSATURATION: ONE MORE PERIL FOR SALMON AND STEELHEAD,
Washington State Water Research Center, Pullman.
For primary bibliographic entry see Field 8I.
W77-05768

PROGRESS REPORT, EVALUATION OF FISH PROTECTIVE FACILITIES AT LITTLE GOOSE DAM AND REVIEW OF OTHER STUDIES RELATING TO PROTECTION OF JUVENILE SALMONIDS IN THE COLUMBIA AND SNAKE RIVERS, 1973,
National Marine Fisheries Service, Seattle, Wash.
For primary bibliographic entry see Field 8I.
W77-05769

PROGRESS REPORT, EVALUATION OF FISH PROTECTIVE FACILITIES AT LITTLE GOOSE DAM AND REVIEW OF OTHER STUDIES RELATING TO PROTECTION OF JUVENILE SALMONIDS IN THE COLUMBIA AND SNAKE RIVERS, 1974,
National Marine Fisheries Service, Seattle, Wash., Northwest Fisheries Center.
For primary bibliographic entry see Field 8I.
W77-05770

FINAL REPORT - PART I, EFFECT OF GAS SUPERSATURATED COLUMBIA RIVER WATER ON THE SURVIVAL OF JUVENILE SALMONIDS, APRIL-JUNE, 1972,
National Marine Fisheries Service, Prescott, Oreg. Environmental Field Station.
T. H. Blahm, R. J. McConnell, and G. R. Snyder.
January 1973, 61 p., 7 tab., 8 fig., 9 ref., 4 append.

Descriptors: *Salmon, *Columbia River, *Juvenile fish, Bioassays, *Methodology, Nitrogen, Supersaturation, Fish physiology, *Fish behavior, Depth, Laboratory tests, On-site data collection, Water quality, *Chinook salmon.
Identifiers: *Gas bubble disease, *Nitrogen supersaturation, *Chinook fingerlings, Coho salmon, Symptoms, Nitrogen bioassay tests.

A research program was instituted to determine the survival of ocean bound juvenile chinook and coho salmon exposed to combinations of nitrogen supersaturation and temperature that prevail in the Columbia River, during the spring freshets when the major spills occur. Bioassays were conducted to determine the relationship between nitrogen levels and mortalities as well as the effects of water depth on fish survival. (Katz)
W77-05771

A DISCUSSION OF NITROGEN SUPERSATURATION OF COLUMBIA RIVER WATER IN RELATION TO BASIC PHENOMENON AND THE PHYSICAL LAWS OF GASES,
Chelan County Public Utility District, Wenatchee, Wash.
B. Leman.
Presented at the Association of Power Biologists, Conference, Wenatchee, Washington, Sept. 22, 1971, 23 p, 20 ref., 2 fig., 4 ref.

Descriptors: *Columbia River, Salmon, Atmospheric gas, Salmon, Rainbow trout, *Supersaturation, *Fish pathology, *Fish physiology, *Atmospheric pressure, Freshwater, Temperature, Solubility, Water quality, Physical properties, Nitrogen, Dams.
Identifiers: *Gas bubble disease, *Dissolved nitrogen, *Boyle's Law, Charles Law, *Nitrogen supersaturation, Dalton's Law, *Gas diffusion, Gas absorption.

The theoretical aspects of atmospheric gas supersaturation as related to the salmonid populations of the Columbia River are discussed. The problems of gas supersaturation in rivers and its effects on fish are very complex. Further experimental studies with fish with consideration to the physical laws and medical results are badly needed. (Katz)
W77-05772

SUPERSATURATION OF THE WATER SUPPLY AND OCCURRENCE OF GAS BUBBLE DISEASE AT CULTUS LAKE TROUT HATCHERY,
British Columbia Univ., Vancouver, Inst. of Fisheries.
H. H. Harvey, and S. B. Smith.
Canadian Fish Culturist, No. 30, 1961, p 39-46, 5 fig., 17 ref.

Descriptors: Nitrogen, Dissolved oxygen, *Supersaturation, *Fish hatcheries, *Fish diseases, Water quality, Water analysis, *Water pollution effects, Review, Mortality, Trout, Water levels, Screens, Water supply, Canada, Intakes structures.
Identifiers: *Gas bubble diseases, *Cultus Lake(BC), *Trout hatchery, *Water intake, Screen occlusion, *Oxygen-Nitrogen relationship, British Columbia.

The Trout Hatchery at Cultus Lake, B.C., has been plagued for some years by the appearance of gas bubble disease in the fish. A study of the intake system revealed there were no less than four distinct ways in which the water supply could become supersaturated. These studies are reported that they may serve as object lessons to those involved in the design and construction of hatchery intakes. The importance of quantitative measurement of both oxygen and nitrogen is also stressed. Previous pertinent literature regarding gas bubble disease and experimental methods of analyzing water for dissolved oxygen and nitrogen was discussed. (Katz)
W77-05773

EFFECT OF JOHN DAY DAM ON DISSOLVED NITROGEN CONCENTRATIONS AND SALMON IN THE COLUMBIA RIVER, 1968,
Bureau of Commercial Fisheries, Seattle, Wash.
K. T. Beiningen, and W. J. Ebel.
Transactions of the American Fisheries Society, Vol. 99, 4, p. 664-671, 1970, 5 fig., 5 ref.

Descriptors: *Columbia River, Juvenile fish, *Fish migration, Fish passage, Salmon, Rainbow trout, *Supersaturation, *Nitrogen, Fish diseases, Fish pathology, Mortality, *Spillways, Adult fish, *Dams, Dam sites, Hydraulic turbines.
Identifiers: *Dissolved nitrogen gas, *Lower Columbia River, John Day Dam, *Gas bubble disease, Fish delays, Dalles Dam.

Concentrations of dissolved nitrogen gas were measured in the lower 640 km of the Columbia River from April to September 1968 to determine the effect of newly-constructed John Day Dam on nitrogen saturation downstream. Observations were also made of symptoms of gas bubble disease and mortality in juvenile and adult salmon. Heavy spillway discharge at the dam caused abnormally high (123-143%) supersaturation downstream, and mortalities of juvenile and adult salmon (Oncorhychus spp.) and steelhead trout (Salmo gairdneri) were substantial. Delays in passage at John Day and The Dalles Dams coupled with supersaturation of nitrogen gas caused the mortalities. In future dam construction one or more turbines should be operable before the reservoir is filled. Increasing the flow through the turbines while decreasing flow over the spillways will reduce concentrations of nitrogen. In addition, every possible effort should be made to reduce the delay of salmon passing over dams. (Katz)
W77-05774

THERMAL TOLERANCE OF JUVENILE PACIFIC SALMON AND STEELHEAD TROUT

IN RELATION TO SUPERSATURATION OF NITROGEN GAS,
National Marine Fisheries Service, Seattle, Wash. Biological Lab.
W. J. Ebel, E. M. Dawley, and B. H. Monk.
Fishery Bulletin, Vol. 69(4), 1971, p. 833-843. 6 fig, 10 tab, 11 ref.

Descriptors: *Salmon, Rainbow trout, *Supersaturation, *Thermal water, *Thermal pollution, Thermal powerplants, *Thermal stress, Water pollution, Environmental effects, Mortality, Fish behavior, Nitrogen, Bioassays, Juvenile fish, *Chinook salmon, Coho salmon.
Identifiers: *Juvenile chinook salmon, *Thermal tolerance, Acclimation, Temperatures, *Gas bubble disease, Relative tolerance.

Thermal tolerance of juvenile chinook salmon (Oncorhynchus tshawytscha) coho salmon (O. kisutch), and steelhead trout (Salmo gairdneri), that had been held at various acclimation temperatures was lowered when test water was supersaturated (125-130% of saturation) with nitrogen gas. Increasing the depth of the test tank allowed the fish to compensate somewhat for the supersaturation by sounding, but substantial mortalities still occurred. A comparison of tolerance among the species tested revealed that coho salmon were the most tolerant, chinook salmon next, and steelhead trout the least tolerant to temperature increases in the presence of supersaturation of nitrogen. (Katz)
W77-05775

LEVELS OF NITROGEN SUPERSATURATION AT CHIEF JOSEPH DAM UNDER VARIOUS SPILL CONDITIONS, PHASE I,
Washington State Dept. of Fisheries, Olympia.
T. K. Meekin.
April 1970, 24 p., 8 tab., 7 fig.

Descriptors: *Supersaturation, Nitrogen, *Columbia River, *Dams, Dam sites, Atmospheric gas, Freshwater, On-site investigations, *Spillways, Monitoring, *Water quality, Tailraces, Grand Coulee Dam.
Identifiers: *Chief Joseph Dam, *Spill conditions, Spill volumes.

The dissolved gas contents resulting from seven different spill conditions were determined. The saturation level varied between tests and in different locations in the forebays. Lenses of water containing different levels of nitrogen move through the reservoirs. If the forebay is highly supersaturated, 120% or above, spills up to 200,000 cfs will not significantly increase the saturation. (Katz)
W77-05776

ACTIVE SECRETION OF OXYGEN INTO THE EYE OF FISH,
Albert Einstein Coll. of Medicine, Bronx, N. Y. Dept. of Physiology.
J. B. Wittenberg, and B. A. Wittenberg.
Nature, Vol. 194, 1962, p. 106-107, 1 tab., 15 ref.

Descriptors: *Marine fish, *Fish physiology, Animal biochemistry, Oxygen, Laboratory tests, Fish behavior, Commercial fish, Laboratory techniques.
Identifiers: *Cod, Bluefish, Remora, *Fish eye, *Rete, *Oxygen secretion, *Oxygen tension.

The oxygen tension in the eyes of marine fish varies. In the case of the cod (Gadus morhua) the bluefish (Pomatomous saltatrix) and the remora (Echeneis naucrates) the oxygen tension is greatly in excess of one atmosphere (i.e. 1,000 and 1,300 mm mercury). In the fish species with large (cod) and very large (bluefish and remora), the oxygen tension is very high. (Katz)
W77-05777

PROGRESS REPORT: JULY-SEPTEMBER 1974. EFFECTS OF SUPER-SATURATION OF DISSOLVED GASES ON FISH,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
1974, 4 p.

Descriptors: *Rainbow trout, Nitrogen, *Supersaturation, Juvenile fish, Anadromous fish, Fish migration, *Fish physiology, *Animal biochemistry, *Columbia River, *Proteins, Fish disease, Dams, Dam sites, Pollutant identification.
Identifiers: *Gas bubble disease, Nitrogen supersaturation, *Blood chemistry, Serum calcium, Cholesterol, Total protein, Alkaline phosphatase, Serum potassium.

A series of field studies were made to detect and quantitate blood chemistry changes in juvenile steelhead as a result of their passage through the Sanke River and Lower Columbia River dams. Nitrogen contents varied from 107 to 125%. Decreases in serum calcium, cholesterol total protein, and alkaline phosphatase and increase in serum potassium were observed in steelhead from the Dworshak Hatchery. (Katz)
W77-05778

REPORT TO CORPS OF ENGINEERS, 1973 GAS SUPERSATURATION RESEARCH,
National Marine Fisheries Service, Longview, Wash. Prescott Field Station.
For primary bibliographic entry see Field 5B.
W77-05779

GAS SATURATION AND MODIFYING HYDROLOGICAL FACTORS IN ESTUARINE WATER USED FOR COOLING A STREAM ELECTRIC PLANT,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
T. Kaehler, N. C. Parker, and K. Strawn.
1976, 20 p., 9 fig., 24 ref.

Descriptors: *Thermoelectric plants, Water temperature, Thermal water, *Supersaturation, *Dissolved oxygen, Water quality, Spillways, Photosynthesis, Dissolved oxygen, Nitrogen, Hydrogen ion concentration, Bioassay, On-site investigations, Fish diseases, Fish behavior, *Aquiculture, Discharge(Water), *Texas, Estuaries, *Thermal pollution.
Identifiers: *Gas bubble disease, *Gas saturation, Cedar Bayou(Tex), Trinity Bay(Tex).

The thermal effluent was monitored to determine 24-hr changes in total dissolved gas, conductivity, temperature, turbidity, dissolved oxygen and pH. There was some diminishing of the supersaturation as water moved down the discharge canal. The dragon tooth spillway between the discharge canal and the cooling lake moderated gas saturation to about 100%. As water from the cooling lake flowed over the weir into Trinity Bay the water again became supersaturated. Oxygen saturation in the cooling lake was dependent upon algal activity. Temperature in the heated effluent fell to normal levels before the water entered Trinity Bay. Water quality, as indicated by dissolved oxygen, nitrogen and pH, improved during passage from Cedar Bayou into Trinity Bay. (Katz)
W77-05780

THE SNAKE RIVER SALMON AND STEELHEAD CRISIS, ITS RELATION TO DAMS AND THE NATIONAL ENERGY CRISIS,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
G. B. Collins, W. J. Ebel, G. E. Monan, H. L. Raymond, and G. K. Tononaka.
Processed Report, February 1973, 30 p., 7 tab., 11 fig., 24 ref.

Descriptors: *Chinook salmon, Trout, *Columbia River, Anadromous fish, *Fish migration, *Hydroelectric power, Juvenile fish, Fish behavior, Spillways, Turbines, Mortalities, On-site investigations, *Supersaturation, Nitrogen, Runoff, Fish behavior, Water quality, Fish ladders, Water pollution effects.
Identifiers: *Snake River, Fish screens, Fish bypass.

A review is presented of the hazards to salmon or steelhead posed by the series of hydroelectric dams on the Columbia and Snake Rivers. With high spills waters become supersaturated with dissolved gases. In low flow years, the downstream migrants pass through turbines where more fish are killed directly and others are stunned or injured. Research is being conducted to minimize salmon and steelhead losses due to dams. Trends in the Snake River salmon and steelhead trout populations are given. (Katz)
W77-05781

EFFECT OF RELEASE LOCATION ON SURVIVAL OF JUVENILE FALL CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
W. J. Ebel.
Transactions of the American Fisheries Society, Vol. 99(4), 1970, p. 672-676, 4 tab., 2 fig., 3 ref.

Descriptors: *Chinook salmon, *Columbia River, Fish hatcheries, *Fish migration, *Fish passages, Mortality, *Juvenile fish, Fish behavior, Washington, Oregon, Fish stocking, On-site investigations.
Identifiers: *Juvenile fall chinook salmon, Little White salmon hatchery, *Release sites, Marked salmon, Fish recovery, Group survival.

In June 1968, juvenile chinook salmon from Little White Salmon National Fish Hatchery, Washington, were marked by freeze branding and released at six different locations in the Columbia River downstream from the hatchery. Marked fish were sampled in the estuary to compare survival of the different groups. Survival was more than doubled by transporting the fish to a point below Bonneville Dam (40 km downstream from Little White Salmon Hatchery) but was not appreciably increased by transporting them farther downstream. (Katz)
W77-05782

SNAKE RIVER RUNS OF SALMON AND STEELHEAD TROUT: TRENDS IN ABUNDANCE OF ADULT AND DOWNSTREAM SURVIVAL OF JUVENILES,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
H. L. Raymond.
Processed Report, November, 1974, 13 p, 8 tab., 5 fig., 1 ref.

Descriptors: *Salmon, *Rainbow trout, *Columbia River, Fish population, *Fish migration, *Fish passage, Mortalities, Juvenile fish, Fish hatcheries, Dams, Dam sites, Spillways, Hydraulic turbines, Anadromous fish, *Supersaturation, Nitrogen, *Chinook salmon.
Identifiers: *Snake River, The Dalles Dam, *Gas supersaturation, Fish bypass.

Juvenile fish losses have significantly increased since 1970. From a potential 10 million smolts, less than 500,000 reached The Dalles Dam in 1973. This means that more than twice the number of potential smolts started the downstream migration, but the number of juveniles surviving to The Dalles was only 1/6th the size of the number of fish that migrated before hatcheries started supplementing the runs. Rearing more fish to compensate for losses is not the answer. Hatchery fish, as well as native fish, need protection from losses during their downstream migration. Present information indicates that flip lip devices to reduce concentration of dissolved gases in water, transportation of fish past dams, screening of turbine intakes and

improvement of systems to bypass fish around dams could significantly reduce losses. The potential exists for not only restoring the runs to their former size but significantly increasing numbers of adults returning to the Snake River. (Katz)
W77-05783

GAS SUPERSATURATION RESEARCH - 1975, PRESCOTT FACILITY - NMFS.
National Marine Fisheries Service, Longview, Wash. Prescott Field Station.
1975, 4 p., 1 tab.

Descriptors: Fish behavior, Stress, Mortality, Bioassay, *Columbia River, Depth, Fish disease, On-site investigations, *Monitoring, Data collections, *Nitrogen, *Supersaturation, Hydrostatic pressure.
Identifiers: *Lower Columbia River, *Gas bubble disease, *Nitrogen supersaturation.

The research program at the Prescott Facility involves (1) monitoring the daily gas levels at Prescott, (2) determining the depth distribution of fish in the Columbia River, and (3) determining the effect of hydrostatic pressure on gas bubble disease. (Katz)
W77-05784

REPORT TO CORPS OF ENGINEERS GAS SUPERSATURATION RESEARCH, PRESCOTT FACILITY, 1974,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
T. A. Blahm.
Processed Report, December 1974, 34 p., 3 tab., 7 fig., 3 ref., 7 append. Army Corps of Engineers Contract No. DACW-57-74-F-0414.

Descriptors: *Columbia River, *Salmon, Trout, *Supersaturation, *Fish migration, Anadromous fish, Gases, Nitrogen, Dissolved oxygen, Bioassay, Mortality, On-site investigations, Behavior, Oregon, Pathology, Rainbow trout, Chinook salmon, Cutthroat trout.
Identifiers: Dalles Dam, *Environmental parameters, Gas bubble disease symptoms.

The dissolved gas content of the Columbia River at Prescott, Oregon, during periods of major upstream and downstream migrations of salmonid fishes was determined. Attempts were made to determine the survival of juvenile salmonids exposed to combinations of naturally occurring environmental parameters prevailing in the Columbia River during the normal migration periods. (Katz)
W77-05785

DISSOLVED GAS SUPERSATURATION IN THE COLUMBIA RIVER SYSTEM: SALMONID BIOASSAY AND DEPTH DISTRIBUTION STUDIES, 1973 AND 1974,
Parametrix, Inc., Bellevue, Wash.
For primary bibliographic entry see Field 5B.
W77-05786

DISSOLVED GAS SUPERSATURATION, GRAND COULEE DAM PROJECT, 1973.
Seattle Marine Labs., Seattle, Wash.
For primary bibliographic entry see Field 5A.
W77-05787

THE EARLY LIFE HISTORY OF FISH,
Dunstaffnage Marine Research Lab., Oban (Scotland).
Proceedings of an International Symposium held at Oban, Scotland, May 17-23, 1973. Edited by J. H. S. Blaxter. Vol I of II. Springer-Verlog, New York, 1974. 353 p, 299 fig. ($40.20).

Descriptors: *Life history studies, *Conferences, Surveys, Fish, Eggs, Larvae, Population, *Fish populations, *Distribution patterns, Feeding rates, Metabolism, Reproduction, Spawning, Mortality.

The symposium was held at the Dunstaffnage Marine Research Laboratory and was sponsored by the Advisory Committee on Marine Resources Research. Vol. I of the proceedings contains 29 papers which were presented at the symposium. The dominant theme of the papers was the use of egg and larvel surveys in fish population dynamics. The papers in Vol. I are grouped into the categories of population studies, distribution, and feeding and metabolism. See W77-05822 thru W77-05850) (Chilton-ORNL)
W77-05821

LARVAL MORTALITY IN MARINE FISHES AND THE CRITICAL PERIOD CONCEPT,
Hawaii Inst. of Marine Biology, Honolulu.
For primary bibliographic entry see Field 2L.
W77-05822

LARVAL MORTALITY AND SUBSEQUENT YEAR-CLASS STRENGTH IN THE PLAICE (PLEURONECTES PLATESSA L.),
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 2L.
W77-05823

THE DISTRIBUTION AND MORTALITY OF SOLE EGGS (SOLEA SOLEA L.) IN INSHORE AREAS,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 2L.
W77-05824

SEASONAL CHANGES IN DIMENSIONS AND VIABILITY OF THE DEVELOPING EGGS OF THE CORNISH PILCHARD (SARDINA PILCHARDUS WALBAUM) OFF PLYMOUTH,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 2L.
W77-05825

ENVIRONMENTAL INFLUENCES ON THE SURVIVAL OF NORTH SEA COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
R. R. Dickson, J. G. Pope, and M. J. Holden.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 69-80, 6 tab, 6 fig, 18 ref.

Descriptors: *Environmental effects, Population, Seasonal, Temperature, Size, Growth rates, *Fish populations, *Mortality, Atlantic Ocean, *Water temperature.
Identifiers: Year-class strength, *Cod, North Sea cod, *Sea temperature.

Relationship between year-class size of cod, based on two indices of abundance, and monthly sea temperatures was examined over two sea-surface temperature sections. It was concluded that sea temperature is one of the main factors which has a direct relationship with year-class size of North Sea cod and that the increase in the average size of cod from 1963 onwards has resulted from sea temperatures in the first half of the year falling to a level which has optimized conditions for both hatching and larval survival. (See also W77-05821) (Chilton-ORNL)
W77-05826

SOME FACTORS INFLUENCING EARLY SURVIVAL AND ABUNDANCE OF CLUPEONELLA IN THE SEA OF AZOV,
All-Union Research Inst. of Marine Fisheries and Oceanography, Moscow (USSR).
G. N. Pinus.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 81-86, 1 tab, 16 ref.

Descriptors: *Environmental effects, Population, *Fish populations, *Temperature, *Embryonic growth stage, *Reproduction, Seasonal.
Identifiers: *Tiulka, *Sea of Azov, Clupeonella delicatula delicatula N.

Tiulka (Clupeonella delicatula delicatula N.) is the most abundant fish in the Sea of Azov, with catches amounting to 40-50% of the total fish landed from this sea. A study of conditions for reproduction of tiulka revealed some regularities in abundance fluctuations. Consideration of factors which can affect the strength of tiulka year-classes showed the critical importance of temperature conditions during the period of embryonic development. In years with optimum temperatures (15-18C) continuing for only about 10 days poor year classes resulted, while in years with optimum temperatures continuing for about 20 days a sharp increase in the abundance of recruits was observed. (See also W77-05821) (Chilton-ORNL)
W77-05827

THE POSSIBLE DENSITY-DEPENDENCE OF LARVAL MORTALITY AND ADULT MORTALITY IN FISHES,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 2L.
W77-05829

RELATIONS BETWEEN EGG PRODUCTION, LARVAL PRODUCTION AND SPAWNING STOCK SIZE IN CLYDE HERRING,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 2L.
W77-05831

SEASONAL FLUCTUATIONS IN THE ABUNDANCE OF THE LARVAE OF MACKEREL AND HERRING IN THE NORTHEASTERN ATLANTIC AND NORTH SEA,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 2L.
W77-05834

NEARSHORE DISTRIBUTION OF HAWAIIAN MARINE FISH LARVAE: EFFECTS OF WATER QUALITY, TURBIDITY AND CURRENTS,
Hawaii Inst. of Marine Biology, Honolulu.
J. M. Miller.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 217-231, 2 tab, 8 fig, 14 ref. Sea Grants No. 2-35243 and 04-3-158-29.

Descriptors: Environmental effects, *Distribution, *Larvae, *Marine fish, *Water quality, *Turbidity, *Currents(Water), *Hawaii, Water pollution effects.

Inshore marine fish larvae were unevenly distributed around Maui, Kauai and Oahu, Hawaii. Density, species number and diversity were higher at shallow stations than at deeper ones. Species composition of inshore larvae were different from that of inshore adults. Large numbers of larvae of mesopelagic and offshore pelagic species were found in waters less than 10 m deep. The abundance of inshore larvae from demersal eggs was inversely correlated with abundance of mesopelagic larvae. Surface zooplankton abundance was higher at the deeper stations. Effects of shoreline development were significant

but obscured by the effects of turbidity and water currents. A 26-fold increase in density of surface larvae occurred at the upstream edge of a small islet off Maui, demonstrating the magnitude and location of the effect of island contact on the abundance of larvae. Smaller increases appeared downstream. (See also W77-05821) (Chilton-ORNL)
W77-05839

CHEMICAL CHANGES DURING GROWTH AND STARVATION OF HERRING LARVAE,
Dunstaffnage Marine Research Lab., Oban (Scotland).
K. F. Ehrlich.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 301-323, 5 tab, 9 fig, 33 ref.

Descriptors: *Metabolism, Chemistry, *Herrings, Animal growth, Foods, Feeding rates, Mortality, *Larvae, Water pollution effects.
Identifiers: Starvation.

Changes in water, triglyceride, carbohydrate, nitrogen, carbon, and ash were followed during ontogenesis from the end of the yolk-sac stage through metamorphosis as well as during starvation of various size groups of herring. Ontogenetic changes were found to be dependent upon larval size rather than age. The percentage of water decreased from 89 to 82%. Up to a size of 20 mm, nitrogen and carbohydrate were laid down faster than was triglyceride but this pattern was altered in larger larvae. During starvation, percent of water increased 4%, percent triglyceride, carbohydrate, and carbon decreased, and the percent nitrogen did not change. Ash increased rapidly as a percentage of the dry weight. Carbon-nitrogen ratio decreased in starved animals. (See also W77-05821) (Chilton-ORNL)
W77-05847

METABOLISM OF NITROGENOUS WASTES IN THE EGGS AND ALEVINS OF RAINBOW TROUT, SALMO GAIRDNERI RICHARDSON,
Kent State Univ., Ohio. Dept. of Biological Science.
S. D. Rice, and R. M. Stokes.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 325-337, 2 tab, 3 fig, 34 ref.

Descriptors: *Metabolism, *Nitrogen compounds, *Wastes, *Eggs, *Rainbow trout, Fry, *Ureas, *Ammonia.
Identifiers: Arginine.

Ammonia, urea, and arginine were found to accumulate during the development of rainbow trout embryos. Both urea and arginine declined in concentration soon after hatching but uric acid showed little change during development. The eggs were shown to be capable of excreting nitrogen and only two of the five O-U cycle enzymes were detected. When arginine from yolk proteins was degraded by arginase, urea appeared to be synthesized. Decrease in total egg protein was accompanied by an increase in free arginine. (See also W77-05821) (Chilton-ORNL)
W77-05848

FEEDING, STARVATION AND WEIGHT CHANGES OF EARLY FISH LARVAE,
Tokyo Univ. of Fisheries (Japan). Fisheries Resources Research Lab.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 339-344, 7 fig, 12 ref.

Descriptors: *Environmental effect, *Feeding rates, Animal growth, Fish, *Larvae, Weight, *Temperature, *Tilapia.
Identifiers: Yolk resorption.

After hatching, the body weights of the larvae of Tilapia sparmanii and Paralichthys olivaceus were found to increase during yolk resorption. The weight gained on the yolk reserves is maximal at the first feeding. The jaw and gut are not fully developed at first feeding and some yolk remains. Although larvae reached first-feeding faster at higher water temperatures, there was no distinct effect of temperatures on the weight gained on the yolk reserves. (See also W77-05821) (Chilton-ORNL)
W77-05849

QUANTITATIVE NUCLEIC ACID HISTOCHEMISTRY OF THE YOLK SAC SYNCYTIUM OF OVIPAROUS TELEOSTS: IMPLICATIONS FOR HYPOTHESES OF YOLK UTILIZATION,
Clemson Univ., S.C. Dept. of Zoology.
W. E. Bachop, and F. J. Schwartz.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 345-353, 1 fig, 4 tab, 18 ref.

Descriptors: *Biochemistry, Fish, *Embryonic growth stage, Larvae, Larval growth stage, *Teleosts.
Identifiers: *DNA, Muskellunge, *Zebra fish.

Normal-appearing muskellunge embryos and zebra fish yolk-sac larvae were placed alive into a fixative for quantitative preservation of DNA. DNA contents of individual nuclei in an individual muskellunge embryo were compared with each other by two-wave length Feulgen microphotomery. The yolk-sac syncytium contained many giant nuclei whose DNA contents were 4 or more times the DNA contents of nuclei within presumably diploid cells of the same embryo. DNA contents of individual nuclei in an individual zebra fish yolk-sac larva were compared with each other by scanning integrating Feulgen microdensitometry. The yolk-sac synctium contents were the same as found in muskellunge embryos. (See also W77-05821) (Chilton-ORNL)
W77-05850

ALGAL GROWTH POTENTIAL OF WASTE WATER EFFLUENTS IN HAWAIIAN RECEIVING WATERS,
Hawaii Univ., Honolulu. Water Resources Research Center.
I. K. Nakatsuka, E. M. Miller, and R. H. F. Young.
Available from the National Technical Information Service, Springfield VA 22161 as PB-265 172, Price codes: A04 in paper copy, A01 in microfiche. Technical Memorandum Report No. 52, November 1976. 52 p, 25 fig, 11 tab, 18 ref, 3 append. OWRT A-065-HI(1). 14-34-0001-6012.

Descriptors: *Water quality, Management, *Sewage effluents, Water pollution effects, *Hawaii, Growth rates, *Waste dilution, Waste disposal, Laboratory tests, Bioassay, Sea water, Freshwater.
Identifiers: Biostimulation, *Glgal growth potential.

A laboratory study was conducted to determine the algal growth potential (AGP) of secondary domestic effluents on stream and marine waters in Hawaii. AGP methods developed by the Environmental Protection Agency were used with effluent-receiving water mixtures representative of nutrient levels found in existing effluent disposal situations. Results of this study are indicative that growth response follows similar patterns for conventional biologically-treated effluents in the four fresh receiving waters tested, with peak growth occurring at a 20% dilution of the effluent. Peak growth conditions occur at a lesser dilution, 40%, in sea water, but this would be an uncommon existing enironmental situation in light of outfall design objectives and current practice. Field conditions exist in fresh water receiving streams in Hawaii where the effluent dilution is 20% or less, so in situations of excessive stimulation or at lesser dilutions, some inhibition of planktonic growth occurs. The growth potential response of 'standard' test alga with Hawaiian waste waters and receiving waters has been demonstrated.
W77-05852

AQUATIC HABITAT INVENTORY IN THE HOT DESERT EIS AREA, UTAH,
Brigham Young Univ., Provo, Utah. Center for Health and Environmental Studies.
For primary bibliographic entry see Field 6G.
W77-05855

PRODUCTION OF JUVENILE CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA, IN A HEATED MODEL STREAM,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
P. A. Bisson, and G. E. Davis.
Fishery Bulletin, Vol 74(4), p 763-774, October, 1976. 3 tab, 8 fig, 30 ref.

Descriptors: *Thermal pollution, Thermal stress, Commercial fish, Salmonids, Salmon, *Chinook salmon, Fry, *Production, *Growth rates, *Fish organisms, Methodology, Laboratory tests, Bioassay, *Water temperature, *Food abundance.
Identifiers: Nanophetus, Trematode parasites, *Diel temperature fluctuations, *Seasonal temperature fluctuations, Spring chinook salmon, *Food availability.

Temperature was elevated approximately 4 deg C in a model stream, compared with an unheated but otherwise similar control stream. The streams were located outdoors and received identical amounts of exchange water from a nearby creek. Diel and seasonal temperature fluctuations were similar to those of area streams. Juvenile spring chinook salmon, Oncorhynchus tshawytscha, were introduced into each stream either as eyed eggs or fry and allowed to remain for approximately 1 yr. Two consecutive year classes of juvenile salmon were studied. Their production was measured triweekly and related to changes in temperature, food availability, and other environmental factors. Ancillary experiments utilizing water from the model streams permitted measurement of differences in growth rate of salmon fed various rations. Salmon production in the control stream exceeded that in the heated stream. In 1972, total production in the control stream was twofold greater and in 1973 it was approximately 30% greater than in the heated stream. Elevated temperature resulted in reduced growth rates of the fish especially as food became less abundant and at times also resulted in lower biomasses of food organisms, either because the temperature increase directly affected survival and growth of benthic invertebrates or because increased sedimentation associated with heavier growth of filamentous algae made riffle substrate less suitable for certain species. Beneficial effects of increased temperature appeared to include protection from infestation by trematode parasite (Nanophyetus salmincola) and, possibly, increased tendencies of some invertebrates to enter the drift. (Katz)
W77-05856

THE EFFECT OF SULPHATES AND PHOSPHATES (INDUSTRIAL WASTES) ON THE MUCOPOLYSACCHARIDES CONTENT OF THE GILLS OF THE EEL ANGUILLA ANGUILLA (L.),
Institute of Ichthyology, Szczecin (Poland). Dept. of Fish Physiology.
R. Zbanyszek.

Acta Ichthyologica et piscatoria, Vol V(2), p 47-64, 1975. 3 tab, 14 fig, 11 ref.

Descriptors: *Industrial wastes, *Sulfates, *Phosphates, Water pollution effects, Environmental effects, Animal physiology, Fish physiology, *Eels, Hydrogen ion concentration, Catadromous fish.
Identifiers: *Mucopolysaccharides, Anguilla, Gill structure(Fish).

Industrial wastes, the main components of which were sulphates and phosphates, induced a decrease in the intensity of staining reactions for mucopolysaccharides (MPS) in the gills of eels. The changes in the MPS content were positively correlated with the vital changes in fishes kept in waste water with an increased sulphate content at a raised pH value. (Katz)
W77-05857

CHANGES IN PERIPHYTON COMMUNITIES UNDER THE EFFECT OF DICHLORFOS,
National Inst. of Hygiene, Warsaw (Poland). Dept. of Communal Hygiene.
J. Stanislawska-Swiatkowska, and B. Ranke-Rybicka.
Polskie Archiwum Hydrobiologii, Vol 23(2), p 261-269, 1976. 2 fig, 25 ref.

Descriptors: Path of pollutants, *Insecticides, *Toxicity, Aquatic organisms, Aquatic algae, *Periphyton, Chlorella, *Protozoa, Biological communities, Succession, Bioassay, Water pollution effects.
Identifiers: *Dichlorfos, Colpidium, Vorticella, *Regeneration.

Experimental studies were carried out to investigate successive periphyton communities remaining under the effect of the insecticides: Dichlorfos (organic phosphorous pesticide - 95.24% chemical preparation) and Nogos-G 50 EC (50% formulated product of Dichlorfos). Of these two substances used in the experiments only Nogos-G caused reduction in the number of organisms coming into the composition of periphyton communities. This pesticide had the strongest effect on the dominant species: Chlorella pyrenoidosa Chick (Algae), Colpidium colpoda Ehr (Protozoa), Vorticella convalaria L., V. microstoma Ehr. (Protozoa), during the first three days following the addition of the active substance (in concentrations higher than 9.9 mg/l.) into the water. A gradual regeneration of periphyton communities, progressing with the passing time, was observed in the course of the experiments. (Katz)
W77-05858

COMBINED ACTION OF POLYPHENOLS, QUINONES, REDUCERS, AND CERTAIN OTHER COMPOUNDS ON AQUATIC PLANTS,
Biologo-Geograficheskii Nauchno-Issledovatelskii Institut, Irkutsk (USSR).
D. J. Strom, and O. M. Kozhova.
Polskie Archiwum Hydrobiologii, Vol 23(3), p 401-408, 1976. 6 tab, 7 ref.

Descriptors: Water pollution, *Water pollution effects, Industrial wastes, *Organic wastes, *Pulp wastes, Pollutants, *Toxicity, Mortality, *Phytoxicity, *Aquatic plants, Path of pollutants, *Bioassay, *Phenols.
Identifiers: Nitella, Elodea, Dunaliella, *Polyphenols, *Quinones.

The toxic action of p-benzoquinone and polyphenols, as pyrocatechol and hydroquinone, on Nitella and Elodea is stipulated by the oxidation products. It is substantially weakened in the presence of thiols (cysteine, glutathione, ethyl-mercaptan) and dosium diethyl dithiocarbamate. These compounds did not influence the toxicity of resorcinol. Cystine and oxidized glutathione did not prevent the action of p-benzoquinone and polyphenols. Addition of ethyl-mercaptan, cysteine and ascorbic acid considerably increased the survival of Dunaliella in hydroquinone solutions. Presence of saccharose and the sodium salt of adenosine triphosphoric acid did not influence the toxic action of p-benzoquinone and polyphenols on aquatic plants. (Katz)
W77-05859

ALGAE IN COPPER TREATED FISH PONDS,
Instytut Rybactwa Srodladowego, Zabieniec (Poland), Dept. of Fish Culture.
M. Januzko.
Polskie Archiwum Hydrobiologii, Vol. 23(1), p. 95-103, 1976. 2 fig, 4 tab, 13 ref.

Descriptors: *Copper compounds, Trace elements, Nutrient requirements, Productivity, *Aquatic algae, *Phytoplankton, Chlorophyta, *Food chains, Fish food organisms, *Fish farming, Carp, Chlorella, Agriculture, Biomass.
Identifiers: Bacillariophyceae, Stephanodiscus sp, Melosira sp.

The population density and biomass of algae in copper-treated ponds increased about twice, as compared with control ponds. An amount of 71 micrograms Cu/l was applied in several portions. Copper especially stimulated the developmet of Bacillariophyceae and Chlorophyta. The dominant species comprised Stephanodiscus Hantzschii Gum, Melosira granulata (Ehrbg.) Ralfs. and Chlorella minutissima Fott. These species were present also in control ponds, though in smaller numbers. The increase in algal density exerted a favorable effect on fish production. (Katz)
W77-05860

PHYSIOLOGICAL EFFECT OF TRIAZINE HERBICIDES ON TYPHA LATIFOLIA L.,
Polish Academy of Sciences, Mikolajki (Poland). Lab. of Chemical Ecology.
J. Krolikowska.
Polskie Archiwum Hydrobiologii, Vol. 23(2), p. 249-259, 1976. 1 tab, 4 fig, 15 ref.

Descriptors: *Herbicides, *Aquatic weed control, *Aquatic plants, Amphibious plants, *Cattails, *Growth rates, *Transpiration, Antitranspirants, Bioassay, Laboratory tests, Water pollution effects, Water pollution control.
Identifiers: *Triazine herbicides.

The effect of six triazine herbicides on transpiration and growth rate of Typha latifolia L. was investigated experimentally. Root application of these herbicides in 0.1, 1.0, and 10.0 g/l concentrations decreases transpiration and growth rate of the plant, depending on the concentration of the applied solution, duration of effect, and age of plant seedlings. The water content in the treated plants was very slightly higher than in the control plants. (Katz)
W77-05861

FISHERY WASTE EFFLUENTS: A METHOD TO DETERMINE RELATIONSHIPS BETWEEN CHEMICAL OXYGEN DEMAND AND RESIDUE,
National Marine Fisheries Service, Kodiak, Alaska. Utilization Research Lab.
For primary bibliographic entry see Field 5A.
W77-05862

AN APPLICATION OF SYSTEMATIC SAMPLING TO A STUDY OF INFAUNA VARIATION IN A SOFT SUBSTRATE ENVIRONMENT,
Washington Univ., Seattle. Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5A.
W77-05863

THE EFFECT OF POLLUTION ON PHOTOSYNTHETIC ACTIVITY OF ALGAE AND PHYSIOLOGICAL ACTIVITY OF BACTERIA IN LAKE,
Warsaw Univ. (Poland). Dept. of Environmental Microbiology; and Zaklad Microbiologica Woody Sci.
R. J. Chrost, and U. Sikorska.
Polskie Archiwum Hydrobiologii, Vol. 23(3), p. 357-364, 1976. 1 tab, 4 figs, 17 ref.

Descriptors: *Municipal wastes, Water pollution effects, *Eutrophication, *Photosynthesis, *Primary productivity, Cycling nutrients, *Aquatic algae, *Phytoplankton, Periphyton, Carbon radioisotopes, *Aquatic bacteria, Chemical analysis, Biochemistry, Lakes, Mineralogy.
Identifiers: *Mineralization, Winkler's method, *Mikolajskie Lake(Poland).

The effect of pollution with communal wastes on the photosynthetic activity of phytoplankton and periphyton and physiological and mineralization activity of bacteria in the Mikolajskie Lake littoral was studied. Heavily polluted environments were found to effect the inhibition of photosynthetic activity of the periphyton whereas the activity of the phytoplankton was unaltered. The physiological and mineralization activity of bacteria in heavily polluted environments was observed to be lower than in parts of the lake not subjected to direct pollution by wastes. The use of the 14-C isotope method for the determination of primary algal production in heavily polluted environments proved superior to Winkler's method. (Katz)
W77-05864

MERCURY IN FISH AND SHELLFISH OF THE NORTHEAST PACIFIC. I. PACIFIC HALIBUT, HIPPOGLOSSUS STENOLEPIS,
National Marine Fisheries Service, Seattle, Wash. Pacific Utilization Research Center.
For primary bibliographic entry see Field 5B.
W77-05865

TOXICITY OF DIQUAT AND CUTRINE TO FINGERLING BROWN TROUT,
New York State Dept. of Environmental Conservation, Albany.
H. A. Simonin, and J. C. Skea.
New York Fish and Game Journal, Vol. 24(1), p. 37-45, 1977. 5 tab, 4 fig, 11 ref.

Descriptors: *Herbicides, *Algicides, *Diquat, Copper compounds, *Toxicity, Mortality, Aquatic animals, Freshwater fish, *Brown trout, Fry, Bioassay, Water pollution effects, Lethal limit.
Identifiers: *Cutrine, Synergistic action, Fingerling brown trout, *Diquat dibromide, 96-hr TLm.

The algicide Cutrine (7.1 per cent copper) and aquatic herbicide Diquat (35.3 per cent diquat dibromide) were tested to determine their toxicity to fingerling brown trout. When used alone, Cutrine had a 96-hour TLm of 0.198 milligrams of copper per liter and Diquat had a 96-hour TLm of 20.4 milligrams of diquat cation per liter. The data indicate that in combination the two chemicals acted synergistically. A concentration of 5.5 milligrams of diquat per liter killed only 5 per cent of the test fish after 96 hours, while a copper concentration of 0.162 milligrams killed 30 per cent during the same length of time. When these two concentrations were combined there was no survival after 24 hours. (Katz)
W77-05866

OBSERVATIONS ON SOME MASSIVE FISH KILLS IN LAKE EYRE,
Chief Secretary's Dept., Sydney (Australia). New South Wales Fisheries Branch.
N. V. Ruello.
Australian Journal of Marine and Freshwater Research, Vol. 27(4), p. 551-564, 1976. 2 fig, 1 tab, 7 ref.

Descriptors: *Fishkill, *Saline lakes, Saline water fish, *Salt tolerance, Diptera, Fish food organisms, On-site investigations, *Mortality, *Water temperature, Saline water, *Australia.
Identifiers: Nematalosa erebi, Craterocephalus eyresii, Hairback herring, Hardyhead, Chironomids, Tamytarsus barbitarsis, *Algal bloom, *Lake Eyre(Australia).

Large numbers of dead hairback herring Nematalosa erebi and hardyhead Craterocephalus eyresii were found along the shores of Lake Eyre (Central Australia) in July 1975. The distribution and estimated abundance of dead fishes and the possible causes of the fish mortalities are discussed. High salinity of Lake Eyre, 39 ppth, would seem to be a likely cause. (Katz)
W77-05867

COPPER AS AN INITIATING FACTOR OF VIBRIOSIS (VIBRIO ANGUILLARUM) IN EEL (ANGUILLA ANGUILLA),
Tromsoe Univ. (Norway). Inst. of Biology and Geology.
M. C. Rodsaether, J. Olafsen, J. Raa, K. Myhre, and J. B. Steen.
Journal of Fish Biology, Vol. 10, p. 17-21, 1977. 1 fig, 1 tab, 18 ref.

Descriptors: *Copper, *Heavy metals, Path of pollutants, Water pollution effects, *Fish diseases, Freshwater fish, *Eels, *Pathogenic bacteria, Aquatic microorganisms, Animal pathology, Biochemistry, Laboratory tests, Chemical analysis, Methodology.
Identifiers: *Red pest disease, *Anguilla anguilla, *Vibrio anguillarum, Vibriosis, Commensal association, Blood samples.

Eels (Anguilla anguilla) which were exposed to copper-contaminated fresh water (30-60 micrograms Cu/l) died with signs of vibriosis (Vibrio anguillarum). Eels kept in non-contaminated fresh water (6 micrograms Cu/l) remained healthy. V. anguillarum was shown to be present in the eels with symptoms of vibriosis. It is suggested that V. anguillarum is a common inhabitant of eels and copper can change a commensal association between fish and bacterium to one of pathogenicity. (Katz)
W77-05868

OXYGEN UPTAKE BY RAINBOW TROUT BLOOD, SALMO GAIRDNERI,
Dundee Univ., (Scotland) Dept. of Biological Sciences.
F. B. Eddy.
Journal of Fish Biology, Vol. 10, p. 87-90, 1977. 1 tab, 1 fig, 16 ref.

Descriptors: *Rainbow trout, Freshwater fish, *Fish physiology, *Water temperature, Laboratory tests, Methodology, Thermal pollution, *Water pollution effects, Respiration, *Oxygen requirements, Salmonids.
Identifiers: *Oxygen uptake, *Red blood cells, Blood samples, Hemoglobin variants.

Oxygen uptake rate by rainbow trout red cells was measured in the temperature range 5 to 40C. Between 5 and 20C there was a steady increase in rate and at 20C a maximum rate of 2.5 microliters 02/min/ml red cells occurred, followed by a decline in the rate as the temperature increased. A morphological investigation of the red cell was conducted and possible functions of the nucleus in fish red blood cells are discussed. (Katz)
W77-05869

HISTOPATHOLOGY OF AN ACUTE FIN LESION IN THE SUMMER FLOUNDER, PARALICHTHYS DENTATUS, AND SOME SPECULATIONS ON THE ETIOLOGY OF FIN ROT DISEASE IN THE NEW YORK BIGHT,
National Marine Fisheries Service, Oxford, Md. Middle Atlantic Coastal Fisheries Center.
R. A. Murchelano, and J. Ziskowski.
Journal of Wildlife Diseases, Vol. 13, p. 103-106, 1977. 6 fig, 7 ref.

Descriptors: *Animal pathology, Marine fish, *Demersal fish, *Fish diseases, New York, Water pollution, *Water pollution effects, *Microorganisms, Marine bacteria, Water quality, Water temperature.
Identifiers: Paralichthys dentatus, *Summer flounder, *Fin rot disease(Fish), *Histopathology, Trawl surveys, *New York Bight.

The histopathology of acute fin rot disease in summer flounder, Paralichthys dentatus, from the New York Bight is described. Grossly, caudal and dorsal fin lesions appeared ragged or frayed with no evidence of resolution. Microscopically, there was epidermal and dermal necrosis, congestion, edema, focal and diffuse hemorrhage, and Zenkers necrosis of underlying muscle. Gram-negative bacteria were present in the fin tissues as well as in heart muscle and liver parenchyma. The inflammatory response consisted mostly of macrophages. The significance of the acute disease in summer flounder is discussed in relation to the etiology of fin rot disease in winter flounder from the Bight. (Katz)
W77-05870

HEAVY METAL CONCENTRATIONS IN KIDNEYS OF ESTUARINE RACCOONS FROM FLORIDA,
Florida State Dept. of Health and Rehabilitative Services, Tallahassee. Health Program Office.
For primary bibliographic entry see Field 5B.
W77-05871

SIMAZINE RESIDUE DYNAMICS IN SMALL PONDS,
Fish and Wildlife Service, La Crosse, Wis. Fish Pesticide Research Unit.
For primary bibliographic entry see Field 5B.
W77-05872

THE EFFECTS OF VARIOUS AROCLOR FRACTIONS ON THE POPULATION GROWTH OF CHLORELLA PYRENOIDOSA,
Wheaton Coll., Norton, Mass. Dept. of Biology.
M. L. Hawes, J. C. Krichner, and J. C. Urey.
Bulletin of Environmental Contamination and Toxicology, vol. 15, no. 1, p. 14-18, 1976. 2 tab., 15 ref.

Descriptors: *Polychlorinated biphenyls, Water pollution effects, *Aroclor, Population, *Biomass, *Chlorella, *Aquatic algae, *Primary productivity, Aquatic populations, Density, Algae, Laboratory tests, Productivity, Bioassay.
Identifiers: *Chlorella pyrenoidosa, *Sublethal effects, Aroclor 1242, Aroclor 1254, Aroclor 1268.

Aroclor was used in laboratory tests designed to examine what effects, if any, would be exerted on the population growth of Chlorella pyrenoidosa by various fractions and concentrations of the polychlorinated biphenyl. At a concentration of 1 ppm and at 8 hours after exposure, Aroclor 1242 treated populations were 64% lower in population density than controls. Aroclor 1254 caused a 45% reduction and Aroclor 1268 resulted in 36% reduction. As populations grew, the difference in experimental and control groups lessened and the Aroclor 1268 group was equal to control populations by 56 hours. These results suggest that the initial perturbation was inversely related to the chlorine content of the PCB. Aroclor 1232 tested at 1 ppm caused a 17% reduction of population at 17 hours which increased to 46% at 46 hours. Populations approached control levels with additional time. Aroclor 1232 at 100ppb never caused more than 18% population reduction at 46 hours. (Katz)
W77-05873

ACCUMULATION OF METHOXYCHLOR BY MICROORGANISMS ISOLATED FROM AQUEOUS SYSTEMS,
Southeast Environmental Research Lab., Athens, Ga.
D. F. Paris, and D. L. Lewis.
Bulletin of Environmental Contamination and Toxicology, vol. 15, no. 1, p. 24-32, 1976. 1 tab., 1 fig., 15 ref.

Descriptors: *Path of pollutants, *Pesticides, *Aquatic bacteria, *Aquatic fungi, *Aquatic algae, *Chlorella, *Absorption, *Sorption, Laboratory tests, Food webs, Microorganisms.
Identifiers: *Methoxychlor, Flavobacterium harrisonii, Bacillus subtilis, Aspergillus.

The sorption of pesticides to microorganisms influences the distribution of these compounds in an aquatic system. The alga, Chlorella pyrenoidosa, the bacteria Flavobacterium harrisonii, and Bacillus subtilis and fungi Aspergillus, were exposed to varying concentrations of methoxychlor in the laboratory and the sorptive properties of these microorganisms were established. Amounts of methoxychlor remaining in solution after the microorganisms were removed indicated the sorptive properties. Methoxychlor concentration decreased rapidly in the supernates of the bacterial and algal cultures, reaching equilibrium within 30 minutes. Equilibrium was reached within 16 hours in the fungal system. Autoclaved microorganisms sorbed as much pesticide as the viable cells indicating that it was not the result of a metabolically active process. When microorganisms that had reached equilibrium in media containing methoxychlor were placed in media containing pesticide, desorption equilibrium was reached in the same period of time as in sorption experiments. (Katz)
W77-05874

CHLORINATED HYDROCARBONS AND TOTAL MERCURY IN THE PREY OF THE WHITE-TAILED EAGLE (HALIAEETUS ALBICILLA L.) IN THE QUARKEN STRAITS OF THE GULF OF BOTHNIA, FINLAND,
Kuopio Univ. (Finland). Dept. of Zoology.
J. Koivusaari, I. Nuuja, R. Palokangas, and M.-L. Hattula.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 2, p. 235-241, 1976. 1 tab, 24 ref.

Descriptors: *Common merganser duck, Carnivores, *Food chains, *Path of pollutants, Reproduction, *Chlorinated hydrocarbon pesticides, *Pesticide residues, *DDT, *DDE, *Mercury, *Sculpin, Marine fish, Waterfowl, Water pollution effects, Predation, Mallard duck, DDD, Pikes, Prey fish.
Identifiers: *White tailed eagle, *Quarken strait(Finland), *Baltic Sea, *Bioaccumulation.

Based on a ten-year study to indentify the organisms which constitute the diet of the white-tailed eagle in the Quarken Straits, Finland, fish and birds were sampled and analysed for mercury had chlorinated hydrocarbon content. Mercury, PCB and DDE were detected in all animals studied. DDT was present in all fishes and mallards. Lindane, aldrin and DDD were also identified. The highest concentrations of each residue studied in fish were detected in the fourhorn sculpin (Cottus quadricornis). The great sculpins (Acanthocottus scorpius) were more contaminated than the pikes (Esox lucius) and the ides (Leuciscus idus). The most cantaminatd birds were mainly fish eaters, mergansers, with residue concentrations 10-40 times levels in non-fish-eating birds. It is believed that one of the most important reasons for poor breeding results of the white tailed eagle in the Quarken Straits are the effects of pollutants from fish-eting species in its prey which pass their winter in the southern Baltic. The fish are nonmigratory, so have contaminant residues far less concentrated than from othr Baltic regions. (Katz)
W77-05875

MOVEMENT OF MIREX FROM SEDIMENT AND UPTAKE BY THE HOGCHOKER, TRINECTS MACULATUS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
G. J. Kobylinski, and R. J. Livingston.
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 6, p. 692-698, 1975. 1 tab., 4 fig., 9 ref.

Descriptors: *Path of pollutants, *Absorption, *Sediments, *Insecticides, Movement, *Analytical techniques, *Bioassay, *Benthic fauna, *Pesticide residues, Laboratory tests, Bottom fish, Freshwater fish, Pesticides, Methodology, Testing procedures.
Identifiers: *Trinectes spp., *Hogchoker, *Mirex.

In order to determine the movement of the insecticide, mirex, from sediment, flow-through and static tests were conducted in aquaria with sediments containing 5000, 1650, and 500 ppb mirex. The hogchoker, Trinectes maculatus, a carnivorous fish, was used as the test organism. Mirex contaminated sediments of the static test retained virtually all of the insecticide over a 4 week period. About 40% of the initial concentration was lost from the sediment under constant flow conditions. Uptake of mirex byi tissues showed a dose dependent relationship. Accumulation of the insecticide increased over time and did not appear to reach equilibrium. Mirex in the liver of fish increased significantly with time of the flow-through test. Considerably more mirex was gained by the fish in the static test than was lost from the water, indicating that the fish probably absorbed significant amount of mirex directly from the sediments. (Katz)
W77-05876

DDE POISONING IN WILD GREAT BLUE HERON,
South Dakota State Univ., Brookings. Dept. of Chemistry.
D. J. Call, B. D. Amman, and J. J. Worman.
Bulletin of Environmental Contamination and Toxicology, Vol. 16, No. 3, p. 310-313, 1976. 1 tab., 15 ref.

Descriptors: *Mortality, *Path of pollutants, Pesticides, *Food chains, *Toxicity, *DDE, *Water birds, DDT, *Chlorinated hydrocarbon pesticides, *Pesticide, toxicity, Pesticide residues.
Identifiers: *Great Blue Heron, Tissue analysis, Ardea herodias.

The impact of DDE on eggshell thinning and reproductive failures in raptorian and piscirorous birds has been well documented, but little information is available regarding mortality in wild adult birds due to DDE poisoning. A wild great blue heron (Ardea herodias) was collected in the field in moribund condition and died within a few hours of collection. Tissue analysis for minerals and pesticide residue showed 246 ppm DDE in brain tissue and 570 ppm in liver, wet weight basis. The bird was collected three years after the ban on commercial use of DDT was imposed. In view of the long biological half-life of DDE of 250 days and the longevity of the larger fish-eating avian species, evidence indicates that DDE may have a lingering effect on both mortality and reproductive success in certain birds. (Katz)
W77-05877

BACK-CALCULATED FISH LENGTHS AND HG AND ZN LEVELS FROM RECENT AND 100-YEAR-OLD CLEITHRUM BONES FROM ATLANTIC COD (GADUS MORHUA),
Fisheries and Marine Service, St. Andrews (New Brunswick). Biological Station.
For primary bibliographic entry see Field 5A.
W77-05879

CRITICAL SWIMMING SPEEDS OF COHO SALMON (ONCORHYNCHUS KISUTCH) FRY TO SMOLT STAGES IN RELATION TO SALINITY AND TEMPERATURE,
British Columbia Univ., Vancouver. Inst. of Animal Resource Ecology.
G. J. Glova, and J. E. McInerney.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 151-154, 1977. 3 fig, 15 ref.

Descriptors: *Salmon, *Anadromous fish, Commercial fish, *Fry, Smolt, Juvenile fish, *Salinity, *Temperature, Laboratory tests, *Mortality, *Estuarine environment, Fish migration, *Fish behavior, *Annual physiology.
Identifiers: Oncorhynchus kisutch, *Premature migration, *Coho salmon.

Critical swimming speeds (fork length per second L/s) of early fry, advanced fry, and pre-smolt coho salmon, Oncorhynchus kisutch, surpassed those of smolts. Performances were inversely related to size, varying from a peak of 7.3 L/s in fry to 5.5 L/s in smolts. In early fry to pre-smolt stages, salinity had little effect whereas in smolts a distinct maximum performance occurred near 13%. Swimming performances of all stages varied directly with temperature: maxima occurred between 20 and 23 degrees C. As temperature decreased, critical speeds of early fry declined at a faster rate than that of later stages, the values at 23 and 3 degrees C being 7.2 and 3.5 L/s in early fry and 5.5-3.5 in smolts. This study shows that on a size-related basis underyearling coho are capable swimmers in estuarine conditions. Thus, their apparent failure to survive premature seaward migrations cannot be explained by their inability to perform important locomotor-dependent behaviors. (Katz)
W77-05880

ACCUMULATION AND RELEASE OF FUEL-OIL-DERIVED DIAROMATIC HYDROCARBONS BY THE POLYCHAETE NEANTHES ARENACEODENTATA,
Texas A and M Univ., College Station. Dept. of Biology.
S. S. Rossi, and J. W. Anderson.
Marine Biology, Vol. 39, p. 51-55, 1977. 2 fig, 16 ref.

Descriptors: *Oil, Oil pollution, *Water pollution effects, *Path of pollutants, Toxicity, Laboratory tests, *Biochemistry, Methodology, Annelids, Larvae, Organic compounds, *Animal physiology.
Identifiers: Neanthes arenaceodentata, *Polychaetes, *Naphthalenes, Diaromatic hydrocarbons.

Male and gravid female Neanthes arenaceodentata (Polychaeta) were experimentally exposed to a sublethal concentrtion of No. 2 fuel oil seawater extract for 24 H. Within 1 h both sexes had incorporated, in equal proportions, most of the diaromatic hydrocarbons (naphthalene, methylnaphthalenes) eventually accumulated. No net loss of accumulated naphthalenes was observed during the exposure period. When returned to hydrocarbon-free seawater, male worms slowly released naphthalenes down to undetectable (0.1 ppm) levels in 400 h (17 days). Gravid females retained essentially all of the originally accumulated naphthalenes for 3 weeks, at which time they released their eggs during fertilization, with subsequent dramatic decrease in naphthalenes content. Zygotes and trochophore larvae from exposed females contained 18 ppm naththalenes, accounting for a majority of those amount initially present in parent females. As trochopore larvae developed into 18- segment juveniles, naphthalenes concentrations dropped to near undetectable levels (0.4 ppm) in 21-day old juveniles (= 18-segment worms). When sampled at the next stage of development (32-segment worms) 5 days later (1050 h after exposure to gravid females), offspring were free of naphthalenes. (Katz)
W77-05881

OSMOREGULATION OF THE GRASS SHRIMP PALAEMONETES PUGIO EXPOSED TO POLYCHLORINATED BIPHENYLS (PCB'S). I. EFFECT ON CHLORIDE AND OSMOTIC CONCENTRATIONS AND CHLORIDE AND WATER EXCHANGE KINETICS,
Texas A and M Univ., College Station. Dept. of Biology.
G. Roesijadi, J. W. Anderson, S. P. Petrocelli, and C. S. Giam.
Marine Biology, Vol. 38, p. 343-355, 1976, 67 ref. 2 tab, 7 fig, 67 ref.

Descriptors: *Shrimp, *Polychlorinated biphenyls, *Aroclors, Water pollution effects, Biochemistry, Laboratory tests, Toxicity, *Animal physiology, Methodology, Industrial wastes, Water balance, Crustaceans, *Chlorides.
Identifiers: Palaemonetes pugio, *Grass shrimp, *Osmoregulation, Hemolymph chloride concentrations, Hemolymph osmotic concentration, Chloride space, Chloride flux, Water flux.

Grass shrimp, Palaemonetes pugio, were capable of hypo- and hyper-osmotic regulation of body fluids. Hemolymph chloride and osmotic concentrations were maintained at relatively stable levels over a wide salinity range. Following an abrupt transfer from intermediate (14 and 17 degree/oo) to high (31 and 35 degree/oo) or low (1 and 2 degree /oo) salinities, hemolymph chloride levels exhibited overshoot and undershoot, respectively, of new steady-state levels. Osmotic concentrations exhibited an initial undershoot at low, but not overshoot at high salinity. Chloride space in salinity-acclimated shrimp was relatively stable at salinities from 1 to 35 degrees/oo. Changes in chloride space following salinity transfer paralleled those of hemolymph chloride levels. Rate constants for chloride turnover indicated independent exchanges of sodium and chloride ions. Exposure to sublethal and 96-h LC50 levels of Aroclor (R) 1254 did not seriously alter hemolymph chloride and osmotic concentrations, chloride space or chloride-exchange kinetics in adult shrimp. Disruption of hemolymph chloride regulation in juvenile shrimp was associated with large mortalities not observed in adults. Shrimp exposed to Aroclor 1254 to 17 degrees/oo S exhibited reduced water permeability. Exposure to PCBs did not result in further reduction in permeability at the latter salinities. (See also W76-10075 and W77-05883) (Katz)
W77-05882

OSMOREGULATION OF THE SHRIMP PALAEMONETES PUGIO EXPOSED TO POLYCHLORINATED BIPHENYLS (PCB'S). II. EFFECT ON FREE AMINO ACIDS OF MUSCLE TISSUE,
Texas A and M Univ., College Station. Dept. of Biology.
G. Roesijadi, J. W. Anderson, and C. S. Giam.
Marine Biology, Vol. 38, p. 357-363, 1976. 34 ref. 1 tab, 3 fig, 34 ref.

Descriptors: *Shrimp, *Polychlorinated biphenyls, *Amino acids, *Aroclors, Toxicity, Animal physiology, *Biochemistry, Laboratory tests, *Water pollution effects, Path of pollutants, Methodology, Chemical analysis.
Identifiers: Paleomonetes pugio, *Grass shrimp, Muscle tissue, *Osmotic regulation, *Aroclor 1254.

Glycine was the most abundant free amino acid (FAA) in abdominal muscle of grass shrimp Palaemonetes pugio, accounting for over 50% of the total pool. Arginine, alanine, proline, taurine and serine were also present at relatively high concentrations. Following transfer from 17% to 2 and 32% S, new steady-state levels of total FAA were observed at 72 H. Total FAA and the sum of glycine, alanine and proline exhibited a positive correlation with salinity. Exposure to Aroclor 1254 did not have appreciable effects on total FAA levels, indicating that disruption of intracellular

osmoregulation was not a major consequence of PCB toxicity. However, changes in individual amino acid concentrations in exposed shrimp were reflective of an altered metabolic state. Glycine, which did not show changes immediately following exposure, underwent large decreases after transfer to PCB-free water and indicated a delayed effect of PCB exposure. A correlation between salinity and the sum of glycine, alanine and proline did not exist in exposed shrimp. (See also W76-10075 and W77-05882) (Katz)
W77-05883

SPECIES DIVERSITY OF LITTORAL ZONE FISHES ALONG A PHOSPHORUS-PRODUCTION GRADIENT IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
B. S. Nakashima, D. Gascon, and W. C. Leggett.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 167-170, 1977. 1 tab, 1 fig, 15 ref.

Descriptors: *Primary productivity, *Phosphorus, *Littoral, *Freshwater fish, Ecosystems, *Biological communities, *Biomass, On-site data collections, Sampling, Statistics, *Canada, Lakes, *Vermont.
Identifiers: *Diversity index, Shannon-Weaver formula, *Lake Memphremogog(Que-VT).

The species diversity of littoral zone fish communities in four areas of Lake Memphremagog was positively related to known phosphorous and primary production gradients along the north-south axis of the lake and to the associated north-south differences in macrobenthic and fish biomass. The highest diversity values were found consistently in the highly productive southern areas of the lake and the lowest values in the least productive northern areas. (Katz)
W77-05884

EFFECTS OF KRAFT MILL EFFLUENTS ON JUVENILE SALMON PRODUCTION IN LABORATORY STREAMS,
Oregon Dept. of Fish and Wildlife, Corvallis, Research Div.
W. K. Seim, J. A. Lichatowich, R. H. Ellis, and G. E. Davis.
Water Research, Vol. 11, p. 189-196, 1977. 3 tab, 10 fig, 18 ref.

Descriptors: *Laboratory tests, Salmon, *Chinook salmon, *Juvenile fish, *Pulp productivity, Toxicity, Seasonal.
Identifiers: TL50, *Primary kraft mill effluent, *Stabilized kraft mill effluent, Seasonal fluctuations.

Effects of effluents on juvenile chinook salmon Oncorhynchus tshawytscha were studies in six laboratory streams. Primary effluent (KME) from mill A reduced salmon production at a concentration of 1.5% by volume (0.2 x 96 h TL50) but not at 0.5% (0.7 x 96 h TL50). Fall and spring exposure to stabilized kraft effluent (SKME) from mill A at 1.5% reduced salmonproduction, while in summer experiments, fish production was enhanced at concentrations of up to 4% for mill A and up to 7.5% for mill B. Thus, production values varied with the source and extent of treatment of effluent and perhaps with season. Fish growth was related to food density during some experiments. (Kratz)
W77-05885

THE PERFORMANCE OF ACTIVATED SLUDGE PLANTS COMPARED WITH THE RESULTS OF VARIOUS BACTERIAL TOXICITY TESTS - A STUDY WITH 3, 5-DICHLOROPHENOL,
Hoeschst A. G., Frankfurt am Main (West Germany).
For primary bibliographic entry see Field 5D.
W77-05886

INFLUENCE OF LIPID POOL SIZE ON BIOACCUMULATION OF THE INSECTICIDE CHLORODANE BY NORTHERN REDHORSE SUCKERS (MOXOSTOMA MACROLEPIDOTUM),
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
J. R. Roberts, A. S. W. deFrietas, and M. A. J. Gidney.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 89-97, 1977. 5 tab, 21 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, Water pollution effects, *Path of pollutants, *Lipids, Radioisotopes, Food chains, Freshwater fish, *Suckers, Chemical analysis, Methodology, Laboratory tests, Bioassay, Mercury, *Insecticides.
Identifiers: Northern redhorse suckers, Moxostoma macrolepidotum, *Chlordane, *Bioaccumulation, White suckers, Catastomus commersoni, *Methylmercury, Gastro-intestinal tract, Bioconcentration.

An effect of the lipid pool size on the accumulation and clearance of cis- and transchlordane by northern redhorse suckers (Moxostoma macrolepidotum) has been demonstrated. A Technique was developed using 203 Hg-labeled methylmercury as a tracer, which permits the direct determination of the assimilation efficiency from food and the biological half-life of chlorinated hydrocarbons in terms of individual fish. Tissue retention of the insecticide chlordane in fish was directly proportional to the adiposity of the fish. For a fish containing 2% lipid, half-life of the cis-isomer was 60 days and for the trans-isomer, 33 days. The net assimilation efficiency from food to fish tissue was also influenced by adiposity. These results on uptake and clearance, when used in a simple model for pollutant bioaccumulation, indicated that the steady state concentration of chlordane in fish will not exceed the concentration of chlordane in the diet unless the adiposity of the fish is high. (Katz)
W77-05887

SEASONAL AND DEVELOPMENTAL VARIATION IN THE LETHALITY OF ZINC TO JUVENILE ATLANTIC SALMON (SALMO SALAR),
Fisheries and Marine Services, St. Andrews (New Brunswick). Biological Station.
V. Zitko, and W. G. Carson.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 139-141, 1977. 1 fig, 1 tab, 9 ref.

Descriptors: *Heavy metals, *Zinc, *Toxicity, *Mortality, Water pollution effects, *Atlantic salmon, Juvenile fish, Smolt, *Mine wastes, Laboratory tests, Water quality standards, *Seasonal, *Growth stages, Bioassay, *Lethal limit.
Identifiers: *Incipient lethal level.

The incipient lethal level (ILL) of zinc to juvenile Atlantic salmon (Salmo salar) in fresh water at a water hardness of 14 mg/l varies from 150 to 1000 micrograms/l as a function of season and developmental stage of the fish. The ILL increases from 500 to 1000 micrograms/l during the first year and decreases to 150 micrograms/l in the following spring. The more sensitive stage in the salmon's life history, evidenced by decrease of ILL coincides with and is probably related to initial stages of the parr-smolt transformation. (Katz)
W77-05888

EFFECT OF HEXACHLOROBENZENE ON SOME GROWTH PARAMETERS OF CHLORELLA PYRENOIDOSA,
Biologische Bundesanstalt fuer Land- und Forstwirtschaft, Berlin (West Germany). Institut fuer Pflanzenschutzmittel-forschung.
F. Geike, and C. D. Parasher.
Bulletin of Environmental Contamination and Toxicology, vol. 15, no. 6, p 670-677, 1976. 2 fig, 16 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *Chlorella, *Algae, Environmental effects, *Growth rates, Water pollution effects, Water pollution sources, *Persistence, *Marine algae, *Biomass, *Chlorophyll, Laboratory tests, Pesticides, *Lethal limit, Organic compounds.
Identifiers: *Hexachlorobenzene, *Sublethal effects.

Hexachlorobenzene has been used extensively in agriculture as a pesticide as well as in industry. It is present in high concentrations in the environment, but little is known about its persistence or the action on HCB on plants. The freshwater alga, Chlorella pyrenoidosa was used in the laboratory tests designed to study the effect of HCB on some growth parameters when incubated with HCB at 0.001-10.0 ppm for 46 h with continuous light, HCB decreased growth according to measurements of chlorophyll content, dry matter, carbohydrate content and nitrogen. Incubation with HCB for three months resulted in an increase of chlorophyll over control values in cultures receiving 0.1 and 1.0 ppm HCB and growth was greatly enhanced in all concentrations of HCB after transfer of the cultures from Erlenmeyer-flasks to growth conditions of a 'light-thermostat.' The mode of action of HCB in plants is not known. (Katz)
W77-05889

CHLORINATED HYDROCARBON RESIDUES IN THE FISH IN LAKE TANGANYIKA,
Antwerpen Univ., Wilrijk (Belgium).
H. Deelstra, J. L. Power, and C. T. Kenner.
Bulletin of Environmental Contamination and Toxicology, Vol. 15, No. 6, p. 689-698, 1976. 1 fig., 5 tab., 22 ref.

Descriptors: *Chlorinated hydrocarbon pesticides, *DDT, *DDE, *Pesticide residues, *Tilapia, Freshwater fish, *Agricultural runoff, Lakes, *Manganese, *Zinc, Public health, Heavy metals, Path of pollutants, *Dieldrin, *Endrin, *Copper, Africa.
Identifiers: *Lake Tanganyika, Stolothrissa spp, Limnothrissa spp., Tanzania, Zaire, Zambia, Burundi.

Lake Tanganyika is a nearly closed system that recieves great quantities of pesticides from runoff from neaby cotton plantations while providing both water and fish to the surrounding populations. Eighty-five percent of the total fish catch consists of two clupeid species: Stolothrissa tanganicae and Limnothrissa miodon. The Lates and Luciolates stapersii are predators and represent the balance of the catch. Pesticide analysis of sundried fish samples used as a source of protein indicate that the amounts of chlorinated pesticides, including DDD, DDE, and TDE, were below the allowable limits set in most countries. On the basis of the fresh fish, assuming an average loss during drying of 75%, the values were all less than 0.6 ppm. Adult Tilapia caught in the vicinity of a spillage of pesticides contained very high levels of DDE, TDE, DDT, and endrin. Heavy metal analysis of the oven-dried fish flours was reported, with no lead, cadmium, nickel or cobalt detected in the samples. (Katz).
W77-05890

EFFECTS OF LOW CONTRATIONS OF MANGANOUS SULFATE ON EGGS AND FRY OF RAINBOW TROUT,
Arizona State Univ., Tempe. Dept. of Zoology.
M. Lewis.
The Progressive Fish-Culturist, Vol. 38, No. 2, p. 63-65, April 1976. 1 tab., 2 fig., 15 ref.

Descriptors: *Environmental effects, *Toxicity, *Mortality, Water pollution effects, *Manganese,

*Rainbow trout, *Fish eggs, *Growth stages, Fry, *Bioassay, *Sulfates, Laboratory tests, Mine wastes, Water pollution sources, *Pennsylvania.
Identifiers: *Manganous sulfate.

Manganous salts can occur in streams at concentrations 50 to 350 times normal levels found in unpolluted streams, as a result of inflow of mine wastes. Lethal manganous concentrations have been found to range from 50 to 5,500 mg/l for adult fish. The effect of low manganous sulfate concentrations (1, 5, and 10 mg/l) to eggs of rainbow trout and to two growth stages of fry were evaluated. Egg mortality increased with increase in manganous sulfate concentrations with apparent increased toxicity at days 7 and 29 of development. No significant difference in mortalty of trout fry exposed to the three test concentrations was observed within 72 hours. The fry were 4 to 7 weeks old. Fish used in the avoidance response test were statistically unbiassed in their choice of channel at concentrations of manganous sulfate up to 10 mg/l. (Katz)
W77-05891

CARBON FILTER FOR REMOVING THERAPEUTANTS FROM HATCHERY WATER,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
L. L. Marking, and R. G. Piper.
The Progressive Fish-Culturist, Vol. 38, No. 2, p. 69-72, April 1976. 3 fig., 3 tab., 6 ref.

Descriptors: *Pesticides, *Aquiculture, *Actiated carbon, *Water purification, Design, *Filters, *Carbon filters, *Filtration, *Ammonia, *Fish farming, Dissolved oxygen, Adsorption, Water quality control, Water treatment, Fish diseases, Waste water treatment.
Identifiers: *Furanace, *Therapeutants, Nitrofuran.

Activated carbon is useful as a filter for removing therapeutants from treated water in hatcheries. A practical filter was designed to accomodate raceway quantities of treated water including the mechanical requirements for the system. The therapeutant used to evaluate the filter was Furanace, a nitrofuran used for the treatment of some fish diseases. The filter consisted of a specially prepared 55-gallon drum packed with 45 kg of granular activated carbon and fitted with spacer racks and a pump. The filtration system was found to be effective in removing Furanace from raceway water, in both static and flow-trhough treatments. Laboratory tests suggested that the carbon was efficient with two turnovers of bed volume per minute. At that rate, the optimum flow through the 208-liter drum was about 185 1/min. (Katz)
W77-05892

PLEXIGLAS CAGES FOR THE STUDY OF BIOLOGICAL EFFECTS OF INDUSTRIAL EFFLUENTS,
Noranda Research Centre, Ponte Claire (Quebec). Ecology Section.
C. E. Delisle, and D. J. Allan.
The Progressive Fish-Culturist, Vol. 38, No. 2, p. 114-116, April 1976. 3 fig., 4 ref.

Descriptors: *Design, *Toxicity, *On-site investigations, *Methodology, *Bioassay, Effluents, *Bioindicators, *Analytical techniques, Water quality, On-site tests, Testing procedures, Invertebrates, Larvae, *Salmon, *Crabs, *Lobsters, *Industrial wastes.
Identifiers: Plexiglas cages.

As a complement to long-term bioaccumulation or sublethal laboratory testing of specific toxicants on aquatic life, in situ bioassays are a practical method of establishing toxicities of effluents under natural conditions. Plexiglas cages designed for in situ testing are described in detail and consist of a large collapsible case and a small non-collapsible cage suitable for experimentation with invertebrates. Salmon smolts (Salmo salar), crabs (Cancer irroratus) and adult lobster (Homarus americanus), kept on these cages for 3 weeks adapted well and suffered no external damage during handling or exposure. Plecoptera and Trichoptera larvae, in fresh water, adapted well to the small cages. The use of these cages provides an accurate, realistic, and inexpensive means of determing whether an effluent is toxic to the aquatic organisms within the test period. (Katz)
W77-05893

FATE AND EFFECT OF NAPHTHALENES: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Skidaway Inst., of Oceanography, Savannah, Ga.
R. F. Lee, and J. W. Anderson.
Bulletin of Marine Science, Vol. 27(1), p. 127-134, 1977. 1 fig, 3 tab, 22 ref.

Descriptors: *Zooplankton, Marine bacteria, *Phytoplankton, Copepods, Microbial degradation, On-site degradation, On-site data collection, *Bioassay, Oil pollution, *Water pollution effects, *Path of pollutants, Toxicity, Mortality.
Identifiers: *Controlled experimental ecosystem, *Naphthalenes, Ctenophores.

Approximately 10 g of napthalenes (2 g of naphthalene, 4 g of methylnaphthalene, and 4 g of dimethylnaphthalenes) resulting in a nonimal concentration of 160 micrograms per liter, were added to 0.25-scle CEPEX enclosure during June, 1975 (ca. 2 m diameter and 15 m deep-68, 000 liters). A second enclosure was retained as a control. After 1 day the amount of naphthalenes in the water was reduced by 50% and concentrations gradually decreased to near background during the following 20 days. Most of the decrease of naphthalenes could be accounted for by adsorption to sinking phytoplankton and microbial degradation. An immediate 'crash' in the phytoplankton population of both treated and untreated enclosures was observed and 3.2 g of napthalenes were associated with sediment on day 4. the sediment was inriched in methylnaphthalenes (1500mg) and dimethylnapthalenes (1400 mg) with naphtalene a minor component (220 mg). Microbial degradation of naphthalene at a depth of 5-10 m rose from 0.04 micrograms per liter per day from day zero to 3.3 micrograms per liter per day after 3 days. Thus, on day 3, 18% of the 360 mg of napthalene from the 5-10 m water was broken down to CO2 during the 24-h incubation. Because of the immediate decline in the phytoplankton population in both enclosures, no studies were made of the effects of napthalenes on phytoplankton. There was an immediate decline in the ctanophores in the treated enclosure, which was predicted from laboratory bioassay studies. Stocks copepods were comparable in the two enclosures. (Katz)
W77-05894

BIOLOGICAL TRANSPORT OF COPPER AT LOCH EWE AND SAANICH INLET: CONTROLLED ECOSYSTEM POLLUTION EXPERIMENT,
Marine Lab., Aberdeen (Scotland).
For primary bibliographic entry see Field 5B.
W77-05895

A PROCEDURE FOR THE ROUTINE BIOLOGICAL EVALUATION OF URBAN RUNOFF IN SMALL RIVERS,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W77-05896

RESPONSE OF EPIPHYTIC BACTERIA TO THE TREATMENT OF TWO AQUATIC MACROPHYTES WITH THE HERBICIDE PARAQUAT,
University of Wales Inst., of Science and Technology, Cardiff. Dept. of Applied Biology.
Water Research, vol. 10, p. 453-459, 1976. 4 fig, 5 tab, 19 ref.

Descriptors: *Aquatic plants, *Chara, *Aquatic bacteria, *Herbicides, *Paraquat, *Water pollution effects, Toxicity, Mortality, Adsorption, Nutrients, *Growth stages.
Identifiers: *Elodea, *Epiphytic bacteria, Aquatic macrophytes.

A mixed stand of aquatic macrophytes, including Elodea and Chara, was treated with 1.5 mg 1l paraquat. Total numbers of epiphytic bacteria and viable numbers in different physiological groups were studied. The epiphytes of Elodea, which had died after 15 days, had all increased in number by ten days. Those on Chara, which survived, did not increase except for a short-lived initial rise. These results were explained by the presence of paraquat in the water and the release of nutrients by the treated plants. (Katz)
W77-05897

DATA FOR SUBSTANTIATING THE PERMISSIBLE LEVEL OF BORON CONTENT IN DRINKING WATER, (IN RUSSIAN),
Institute of General and Municipal Hygiene, Moscow (USSR).
A. I. Borisov.
Gig Sanit 1, p 11-16, 1976.

Descriptors: *Boron, *Lethal limit, *Potable water, *Pollutant identification, *Toxicity, Rodents, Water pollution effects.

Subacute and chronic experiments (in rats) showed B to have a pronounced gonadotoxic effect. Considering these results and field observations, the recommended maximum permissible concentration of B in drinking water is 0.5 mg/l.–Copyright 1976, Biological Abstracts, Inc.
W77-05898

DIALYSIS MEMBRANE CHAMBERS AS A DEVICE FOR EVALUATING IMPACTS OF POLLUTANTS ON PLANKTON UNDER NATURAL CONDITIONS,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
C. D. Powers, R. G. Rowland, and C. F. Wurster.
Water Research, vol. 10, p. 991-994, 1976. 2 fig, 1 tab, 20 ref.

Descriptors: *Laboratory tests, On-site investigations, *Dinoflagellates, Phytoplankton, *Growth rates, *DDE, *Chlorinated hydrocarbon pesticides, Water pollution effects, Toxicity, *Methodology, *Marine algae, Pollutant identification.
Identifiers: Exuviella baltica, *Dialysis membrane chambers.

Growth rates of a marine dinoflagellate, treated with DDE at 1, 5 or 10 parts per thousand million (109;ptm) and cultured in dialysis membrane bags suspended in the tidal channel of an estuarine marsh, were compared with growth rates of untreated organisms cultured under the same conditions or as laboratory (batch) cultures in natural water or nutrient enriched artificial seawater. DDE-treated cells were inhibited (relative to controls) for 2-4 days, consistent with previous laboratory tests which revealed the high sensitivity of this organism to low concentrations of DDE. Untreaed cells in dialysis bags in the estuary grew at a faster rate after the first few hours than either type of batch culture, and yielded a higher final cell density than laboratory cultures utilizing the same natural water. (Katz)
W77-05899

STUDIES ON THE MORTALITY OF THE HARD CLAM MERETRIX LUSORIA (RODING) IN BUAN FARMING AREA, (IN JAPANESE),
Pusan National Univ. (Republic of Korea). Inst. of Marine Sciences.
S. K. Yoo.
Publications of the Institute of Marine Sciences National Fisheries, University of Busan, Vol. 8, p. 39-52, 1975. 10 fig, 8 tab, 34 ref.

Descriptors: *Clams, *Commerical shellfish, *Mortality, Aquatic environment, Salinity, Temperature, *Water temperature, Animal parasites, Trematodes, Marine bacteria, Respiration, *Agriculture, *Animal physiology.
Identifiers: *Hard clams, Meretrix lusoria, *Korea(Buan farming area).

In the Buan area the annual production of the hard clam, Meretrix lusoria has been decreased since 1972. It is reported that the low production of the clam has been brought by mass mortality caused by some factors which have not been fully understood. In order to know the ecological problems of their mass mortality, a preliminary study has been conducted based on the environmental factors, respiratory physiology of the clam, trematode parasites and marine bacteriological urvey. Sand grain was dominant that it was over 81-96% in the grain size composition of the substratum. Minimum temperature of the substratum during exposure ranged from 4 to 7 C in February; maximum temperature ranged from 30 to 32 C in August. (Katz)
W77-05900

EFFECT OF SIZE OR AGE OF GOLDFISH AND FATHEAD MINNOWS ON USE OF PENTACHLOROPHENOL AS A REFERENCE TOXICANT,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
I. R. Adelman, L. L. Smith, Jr., and G. D. Siesennop.
Water Research, Vol. 10, p. 685-687, 1976. 1 fig, 3 tab, 11 ref.

Descriptors: *Bioassays, *Minnows, Laboratory tests, *Age, Juvenile fish, *Size, *Toxicity, Mortality, Water pollution effects, Statistics, *Herbicides, *Methodology, *Phenols.
Identifiers: *Fathead minnows, Pimephales promelas, *Goldfish, Carassius auratus, LC50, Acute toxicity, *Pentachlorophenol.

Acute bioassays of pentachlorophenol were conducted with fathead minnows and goldfish to determine the effect of testing different sized fish of the same age or testing different aged fish. With different sized goldfish the rate of mortality during the test was similar but the threshold LC50 was higher for small fish. With different sized fathead minnows the rate of mortality during the test was significantly different but the threshold LC50 was the same for large and small fish. With different aged fathead minnows the rate of mortality was different for 14-week-old fish and the same for 11-, 7-, and 4-week-old fish but there was no difference in threshold LC50 due to age. Size selection of fatheads or goldfish within the ranges tested is unneccessary since difference are small. Since age of fatheads did not affect the 24-h, 96-h, or threshold LC50's, use of younger fish would allow smaller bioassay chambers or more fish per chamber. (Katz)
W77-05901

CHANGING LOBSTER ABUNDANCE AND THE DESTRUCTION OF KELP BEDS BY SEA URCHINS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
P. A. Breen, and K. H. Mann.
Marine Biology, Vol. 34, p. 137-142, 1976. 7 fig, 1 tab, 34 ref.

Descriptors: *Kelps, *Lobsters, Commercial shellfish, *Biological communities, *Predation, On-site data collections, *Marine algae, Management, On-site investigations, Crustaceans, Marine fisheries, *Canada.
Identifiers: Strongylocentrotus droebachiensis, Laminaria spp., Sea urchins, Nova Scotia.

In a study area in Nova Scotia, Canada, abundance of the lobster Homarus americanus decreased by nearly 50% in 14 years. The lobster is a major predator of sea urchins, and during the past 6 years the sea urchin, Stronglyocentrotus droebachiensis has destroyed 70% of the beds of Laminaria spp. in the area. Implications for management are duscussed. (Katz)
W77-05902

COMMUNITY STRUCTURE AND THE EFFECTS OF POLLUTION IN SEA-GRASS MEADOWS AND ADJACENT HABITATS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
K. L. Heck, Jr.
Marine Biology, Vol. 35, p. 345-357, 1976. 6 fig, 4 tab, 32 ref.

Descriptors: *Pulp and paper industry, *Pulp wastes, Chemical wastes, Water pollution effects, Path of pollutants, Bioindicators, *Biological communities, *Salt marshes, *Oysters, *Mudflats, Dominant organisms, Benthos, *Florida, *Estuarine environment.
Identifiers: Cluster analysis, Dominance index, Analysis of variance, *Sea-grass beds.

Differences in the structure of epibenthic invertebrate species assemblages were investigated in two estuarine areas in Apalachee Bay, Florida (USA), and related to the presence or absence of pulp-mill effluents. Invertebrate species associated with sea-grass beds, mud flats, and oyster reefs were included in the analyses. Surprisingly, several commonly used indicators of pollution stress were ineffective in differentiating the study areas, even though there were large difference in abundance and dominance relationships between them, and these differences were clearly related to the presence of the pulp-mill effluents. Recommendations for data analyses in similar types of studies are made based on the results of this investigation and others in the same study areas. (Katz)
W77-05903

EFFECTS OF ANAESTHESIA WITH MS222, NEUTRALIZED MS 222 AND BENZOCAINE ON THE BLOOD CONSTITUENTS OF RAINBOW TROUT, SALMO GAIRDNERI,
Helsinki Univ. (Finland). Dept. of Physiological Zoology.
A. Soivio, K. Nyholm, and M. Huhti.
Journal of Fish Biology, Vol. 10, p. 91-101, 1977. 4 fig, 1 tab, 26 ref.

Descriptors: *Rainbow trout, Salmonids, Freshwater fish, Chemical analysis, *Laboratory tests, *Animal physiology, *Fish physiology, *Methodology, Bio-chemistry, *Analytical techniques, Aquaculture.
Identifiers: *Blood samples, *Anesthesia, *MS222, Benzocaine.

Rainbow trout (Salmo gairdneri) Richardson, were subjected to 15 min anesthesia with unbuffered MS222, neutralized MS 222 and benzocaine with and without physical stress. Blood samples were taken through cannulae inserted into the dorsal aorta. The Hct values and Hb concentrations increased with all the anesthetics, which also caused swelling of erythrocytes. The initial values were restored within 4-12 h of recovery. Each anesthetic elevated the blood lactate concentration, but the initial level was regained within 12 h. The blood glucose level decreased the most during anesthesia with unbuffered MS 222, but the initial level was rapidly restored. Benzocaine caused the least hypoglycemia during anesthesia, but the subsequent hyperglycemia, as in the fish anesthetized with neutralized MS 222, lasted 24 h. Neutralized MS 222 and benzocaine elevated the plasma K+ concentration more rapidly than unbuffered MS 222. The initial levels were regained in 4 days. All anesthetics raised the MG++ concentration. The PO2 in the dorsal aorta decreased during anesthesia with unbuffered MS 222 by about 85 mmHg, while the PCO2 increased by about 1-5 mmHg. Their initial levels were regained within 20 min. During anesthesia the pH value decreased by 0-3 units and returned to the initial value within 2-4 h of recovery. MS 222
W77-05904

RATE OF CONVERSION OF 14-C-P-P' -DDT TO P,P'- DDE BY BROOK TROUT (SALVELINUS FONTINALIS): ABSENCE OF EFFECT OF PRETREATMENT OF FISH WITH COMPOUNDS RELATED TO P,P' -DDT,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
R. F. Addison, and M. E. Zinck.
Journal of the Fisheries Research Board of Canada, Vol. 34, p. 119-122, 1977. 1 fig, 2 tab, 12 ref.

Descriptors: *Brook trout, *DDT, *DDE, *DDD, *Chlorinated hydrocarbon pesticides, Biochemistry, Laboratory tests, Lipids, Regression analysis, Carbon radioisotopes, Biodegradation, *Water pollution effects.
Identifiers: *DDMU, Salvelinus fontinalis, *Dehydrochlorinating system, Mixed function oxidases.

Brook trout (Salvelinus fontinalis) were given four injections at weekly intervals of either p,p'-DDT, p,p'-DDE, p,p'-DDD, or p,p'-DDMU to yield tissue concentrations of 1-5 mg/kg wet wt. The effect of these treatments on the subsequent dehydrochlorination of an injection of 14-C-p,p'-DDT was investigated. The rate of dehydrochlorination of 14-C-p,p'-DDT by the trout was not influenced by these treatments and was more highly correlated with factors such as the weight of the fish and their lipid content. Of the compounds injected during the treatment of the fish, p,p'-DDMU was cleared more rapidly than the others. (Katz)
W77-05905

EFFECTS OF A SPILL OF MARINE DIESEL OIL ON THE ROCKY SHORE FAUNA OF LAMMA ISLAND, HONG KONG,
Marine Lab., Aberdeen (Scotland).
H. P. Stirling.
Environmental Pollution, Vol. 12, p. 93-117, 1977. 8 fig, 2 tab, 20 ref.

Descriptors: *Oil, *Oil pollution, *Water pollution effects, *Path of pollutants, *Toxicity, *Mortality, *Marine organisms, *Intertidal areas, *Oil spills, Mollusks, Indicators, Crustaceans, Gastropods, Dispersion.
Identifiers: Bivalves, *Effects of dispersants, *Long-term effects, *Shore crabs, *Rocky shores, *Diesel oil, *Hong Kong(Lamma Island).

The acute toxic and long-term ecological effects of marine diesel oil on common littoral fauna were studied at three rocky shores on Lamma Island, Hong Kong, which were contaminated to different degrees. Acute mortality of gastropods was greatest at the moderately contaminated site where oil-dispersant chemicals were applied to floating slicks nearby, but long-term disturbances were most significant at the heavily oiled site where dispersants were not used. Animals were collected on the oiled beaches and taken to the laboratory, where their recovery in clean seawater was studied. This indicated that bivalve molluscs and the gastropods Monodonta labio and Thais clavigera were the most sensitive and Cyl-

peomorus humilis and Planaxis sulcatus the least. Field observations of acute mortality were consistent with this order of species sensitivity. The greatest population reduction was observed in Monodonta labio and Nerita albicilla which were eliminated for at least 13 months from the site receiving the most oil. Species resistant to oil in recovery experiments did not show significant long-term reductions. (Katz)
W77-05906

TOXICITY OF PENTACHLOROPHENOL AND 2,3,6- TRICHLOROPHENOL TO THE CRAYFISH (ASTACUS FLUVIATILIS L.),
Helsinki Univ. (Finland). Dept. of Physiological Zoology.
K. Kaila, and J. Saarikoski.
Environmental Pollution, Vol. 12, p. 119-123, 1977. 1 fig, 2 tab, 16 ref.

Descriptors: *Bioassay, *Crayfish, *Toxicity, Mortality, *Chemical wastes, Industrial wastes, Wood wastes, Laboratory tests, Hydrogenation, Concentration, *Water pollution effects, *Phenols, *Herbicides, *Crustaceans.
Identifiers: LC50, LD50, *Astacus fluviatilis.

The toxicity of pentachlorphenol (PCP) and 2,3,6-trichlorophenol (TCP) to the crayfish (Astacus fluviatilis L.) was measured at two pH levels. The eight-day LC50 estimates obtained were 53 ppm for PCP and 19 ppm for TCP, at pH 7.5 (13 degrees C). Lowering of the pH to 6.5 increased the toxicity of PCP by a factor of 5.9 and that of TCP by 3.5. Both factors are significantly smaller than could be expected if only the concentrations of the non-ionized chlorophenol molecules were essential. On a weight bases, TCP was more toxic than PCP also at pH 6.5. The LD50 estimates obtained by injection were, however, lower for PCP than for TCP, suggesting that the latter may penetrate more rapidly into the crayfish. This in in agreement with the smaller degree of ionization of TCP due to its higher pKa value. (Katz)
W77-05907

EFFECTS OF SPECIES, SEX, LENGTH AND LOCALITY ON THE MERCURY CONTENT OF SCHOOL SHARK GALEORHINUS AUSTRALIS (MACLEY) AND THE GUMMY SHARK MUSTELUS ANTARCTICUS GUENTHER FROM SOUTH-EASTERN AUSTRALIAN WATERS,
Victoria Ministry for Conservation, Melbourne (Australia). Fisheries and Wildlife Div.
T. I. Walker.
Australian Journal of Marine and Freshwater Research, Vol. 27(4), p. 603-616, 1976. 1 fig, 7 tab, 9 ref.

Descriptors: *Sharks, *Commercial fish, *Public health, *Mercury, Heavy metals, Water pollution effects, *Path of pollutants, Chemical analysis, *Marine fish, Food chain, Growth rates, *Australia, Coasts.
Identifiers: Galeorhinus australis, Mustelus antarcticus, *School shark, *Gummy shark, Muscle tissues.

The mercury levels detected in the muscle tissues of sharks ranged from 0.01 to 2.7 ppm wet weight for school shark Galeorhinus australis (Macleay) and from 0.07 to 3.0 ppm for gummy shark Mustelus antarcticus Guenther. Estimates of mean mercury levels for the 1971 Victorian landed commercial shark catch were found to be 0.90 ppm for the school shark and 0.37 ppm for the gummy shark. The analyses for total mercury determinations were carried out by five independent laboratories. Preliminary analyses carried out by one indicated that most of the mercury in gummy sharks was present as methylmercury. The mercury concentrations varied experimentally with shark length. School sharks had statistically significantly higher mercury levels than gummy sharks of the same length and for both the medium-sized and large individuals of each species males had significantly higher levels than females. Levels in male gummy sharks were found to be affected by locality. (Katz)
W77-05908

INGESTION OF SUSPENDED OIL PARTICLES AND THE INFLUENCES ON MORTALITY IN THE MOLLUSCAN LARVAE, (IN JAPANESE),
Nansei Regional Fisheries Research Lab., Maruishi (Japan).
S. Umezawa, O. Fukuhara, and S. Sakaguchi.
Bulletin of the Nansei Regional Fisheries Research Laboratory, Vol. 9, p. 77-82, 1976. 6 fig, 1 ref.

Descriptors: *Oysters, *Commercial shellfish, Mollusks, *Mussels, *Larvae, Oil, Path of pollutants, *Toxicity, Mortality, *Oil pollution, Water pollution effects, Laboratory tests, Larvae, *Absorption.
Identifiers: Crassostrea gigas, Mytilus, Suspended oil particles, Mulluscan larvae.

The larvae of oyster, Crassostrea gigas and mussel Mytilus spp. obtained from nature, were kept in seawaters in which different concentrations of oil droplets were added to examine the ingestion of the suspended oil droplets and its influences on mortality in these molluscan larvae. The experimental media were prepared by dilution of the original oil-sea-water mixture made by homogenizing 10 g of TC oil in one liter of filtered seawater. The percentage of the larvae with ingested oil droplets and the diameter of the oil droplets in the stomach of each larvae became greater according to increase of oil droplets concentration with experimental medium. The greater the concentration of oil droplets in the medium the higher was the mortality rate among the experimental larvae. An evidence was obtained that the ingestion and subsequent cohension of oil droplets was the main cause of their mortality. It was observed that the molluscan larvae, unlike Tigriopus and Brachionus, were not able to excrude oil droplets ingested in their stomachs. (Katz)
W77-05909

INHIBITION OF MARINE ALGAL PHOTOSYNTHESIS BY HEAVY METALS,
Institute of Marine Biochemistry, Aberdeen (Scotland).
J. Overnell.
Marine Biology, Vol. 38, p. 335-342, 1976. 3 fig, 1 tab, 16 ref.

Descriptors: *Heavy metals, *Marine algae, *Diatoms, Photosynthesis, *Water pollution effects, *Bioassay, Biochemistry, *Copper, *Mercury, *Cadmium, *Zinc, *Herbicides, Bioindicators, Methodology.
Identifiers: Attheya decora, Brachiomonas submarina, Dunaliella tertiolecta, Isochrysis galbana, Monochrysis lutheri, Phaeodactylum tricornutum, Skeletonema costatum.

The maximum rate of light-induced evolution of oxygen by suspensions of cells of the unicellular marine algae Attheya decora, Brachiomonas submarina, Dunaliella tertiolecta, Isochrysis galbana, Monochrysis lutheri, Phaeodactylum tricornutum and Skeletonema costatum was measured. With this bioassay the relative sensitivities of these species of algae towards Cu, Hg, Cd and Zn were compared with that towards the herbicide 3(3,4-dichlorophenyl)-1,1-dimethyl urea. The algae were uniformly sensitive to low concentrations of DCMu; S. costatum and A. decora were especially sensitive to Cu and Hg ions. In contrast, D. tertiolecta was remarkably insensitive to Hg. These results suggest that A. decora could be used as a sensitive indicator of the quality of estuarine water, and a bioassay system based on this is proposed. (Katz)
W77-05910

SEWAGE NUTRIENT ENRICHMENT AND PHYTOPLANKTON ECOLOGY ALONG THE CENTRAL COAST OF LEBANON,
American Univ., Beirut, (Lebanon). Dept. of Biology.
M. J. Taslakian, and J. T. Hardy.
Marine Biology, Vol. 38, p. 315-325, 1976. 6 fig, 1 tab, 29 ref.

Descriptors: *Phytoplankton, *Sewage, *Eutrophication, *Water pollution effects, Nutrients, *Biological communities, *Marine algae, Bioindicators, Cyanophyta, Dinoflagellates, Diatoms, Coasts, *Outfall sewers.
Identifiers: *Mediterranean Sea, *Beirut(Lebanon).

The abundance and taxonomic diversity of phytoplankton has been studied in relation to sewage pollution (proximity to outfalls) south of Beirut, Lebanon, Surface-water samples were collected from a series of beach stations extending from the American University of Beirut to 20 km south from June, 1973 to July, 1974. Water samples from the vicinity of two major sewer outfalls (Carlton and Khalde sewers) showed very high concentrations of NH4+, NO2-, NO3-, and PO4-3, a greater total concentration of phytoplankton, and a lower taxonomic diversity than samples remote from outfalls. A considerable variation in the occurrence of species and dominance occurred along the pollution gradient. Blue-green algae and dinoflagellates were dominant in polluted waters, while diatoms dominated in cleaner water away from major sewage outflow. From the dominance and relative distribution of the taxa along the pollution gradient, certain taxa (Oscillatoria spp., Spirulina spp., Phormidium spp., Synochococcus custos and S. elongatus, Gymnodinium spp., and Prorocentrum spp.) emerge as indicator species of pollution. These changes correspond to a typical degradation of a complex community to a less mature state by the inflow of nutrient-rich sewage (eutrophication) along a coastal region about 10km long. (Katz)
W77-05911

SYNERGISTIC EFFECTS OF CADMIUM AND SALINITY COMBINED WITH CONSTANT AND CYCLING TEMPERATURES ON THE LARVAL DEVELOPMENT OF TWO ESTUARINE CRAB SPECIES,
Duke Univ., Beaufort, N.C. Marine Lab.
R. Rosenberg, and J. D. Costlow, Jr.
Marine Biology, Vol. 38, p. 291-303, 1976. 3 fig, 4 tab, 29 ref.

Descriptors: *Commercial shellfish, *Crabs, *Heavy metals, *Cadmium, *Salinity, Temperature, Laboratory tests, *Larvae, Water pollution effects, *Toxicity, Mortality, Bioassay, Crustaceans, Estuarine environment, North Carolina.
Identifiers: *Blue crab, Callinectes sapidus, *Mud-crab, Rhithropanopeus harrisii, *Synergistic effects, Megalopa, Zoeal larvae, Third crab stage, Temperature fluctuations, T-test, Analysis of variance, Beaufort(NC).

The developmental stages from megalopa to third crab of the blue crab Callinectes sapidus Rathbun were tested in 12 combinations of cadmium (0, 50, and 150 ppb) and salinity (10, 20, 30, and 40%) at 25C. A reduction in survival and a significant delay in development from megalopa to third crab occurred within each salinity regime in 50 ppb compared with the control. Comparison of the delay in development within each salinity regime revealed that the sublethal effect of cadmium was most pronounced in the salinities normally preferred by C. sapidus. A similar comparison within each cadmium concentration, however, showed that the developmental time from megalopa to third crab was approximately the same irrespective of salinity. The developmental stages from hatch to first crab of the mudcrab Rhithropanopeus harrisii (Gould) were examined in 63 combinations of cad-

mium (0, 50 and 150 ppb), salinity (10, 20, and 30%), constant temperature (20C, 25C, 30C, and 35C). The results indicated that cycling temperatures may have a stimulating effect on survival of the larvae compared to constant temperatures, both in the presence and in the absence of cadmium. (Katz)
W77-05912

TRACE METALS IN SOUTHERN CALIFORNIAN MUSSELS,
California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
For primary bibliographic entry see Field 5A.
W77-05914

MERCURY IN PLANKTON FROM A POLLUTED NORWEGIAN FJORD,
Norsk Institutt for Vannforskning, Blindern.
For primary bibliographic entry see Field 5A.
W77-05915

ISOLATION AND IDENTIFICATION OF A POLAR METABOLITE OF TETRACHLOROBIPHENYL FROM BILE OF RAINBOW TROUT EXPOSED TO 14C-TETRACHLOROBIPHENYL,
Medical Coll. of Wisconsin, Milwaukee. Dept. of Pharmacology.
M. J. Melancon, Jr., and J. L. Lech.
Bulletin of Environmental Contamination and Toxicology, vol. 5, no. 2, p. 181-188, 1976. 5 fig., 1 tab., 17 ref.

Descriptors: *Polychlorinated biphenyls, *Chemical analysis, *Rainbow trout, *Metabolism, *Pesticide residues, Pollutant identification, Analytical techniques, Absorption, Pesticides, Chlorinated hydrocarbon pesticides, Laboratory tests, Path of pollutants, Gas chromatography, Organic compounds.
Identifiers: *Tetrachlorobiphenyl, Bioaccumulation.

To determine the ability of rainbow trout to metabolize polychlorinated biphenyls, laboratory fish were exposed to 14C-Tetrachlorobiphenyl (TCB). Bile obtained from test fish was analyzed for TCB and metabolite concentrations. After 24 and 48-hour exposures to 0.5 ppm TCB, bile contained 5.0 and 5.4 ppm respectively, of TCB with metabolites, based on 14C. Conjugated metabolites of TCB were isolated. After glucaronidase hydrolysis, the trimethylsilyl ether of one of the compounds matched the TM5 ether of hydroxy TCB during gas chromatography. Although the extent of TCB metabolism by rainbow trout appears to be slight, even this could be important due to the high level of PCB's in the environment. (Katz)
W77-05916

RESIDUES OF CHLORINATED HYDROCARBONS IN MARINE ORGANISMS IN RELATION TO SIZE AND ECOLOGICAL PARAMETERS, 1. PCB, DDT, DDE AND DDD IN FISHES AND MOLLUSCS FROM THE ENGLISH CHANNEL,
Institut fuer Meeresforschung, Bremerhaven (West Germany).
W. Ernst, H. Goerke, G. Eder, and R. G. Schaefer.
Bulletin of Environmental Contamination and Toxicology, vol. 15, no. 1, p. 55-65, 1976. 1 fig., 6 tab., 9 ref.

Descriptors: *DDT, *DDD, *DDE, *Mollusks, *Pesticide residues, *Polychlorinated biphenyls, *Benthic fauna, *Bottom fish, *Lipids, *Food chains, Size, Metabolism, Absorption, Chemical analysis, Path of pollutants, Gas chromatography, Chlorinated hydrocarbon pesticides, Pollutant identification.
Identifiers: *English Channel, Squid, Scallop, Plaice, Brill, Gurnards, *Tissue analysis(Fish).

Five species of English Channel fish and mollusks were analysed for chlorinated hydrocarbon pesticide residues. Residue concentrations were found to increase with rising lipid content in the order: musculature, liver/digestive gland, visceral adipose tissue. The residue amounts per lipid weight were highest in muscle tissue. This may be due to different metabolic activities in different tissues or to unknown mechanisms of fixation of the pollutants to different matrices. Scallops did not exhibit any correlation between residue concentration and weight. In liver and adipose tissue of gurnard positive correlation between residue concentration and animal weight seem to exist for some of the pollutants. It is necessary to examine whether a rising lipid content of the growing animal is the only cause of a positive correlation between residue level and size. In squid the residue concentrations in muscle tended to decline with increasing animal size. Concentrations of PCB were always higher than those of DDT and metabolites as indicated by PCB/DDT ratios between 3 and 7 in most cases. (Katz)
W77-05917

SELECT MINERALS AND POTABLE REUSE OF RECLAIMED WASTEWATERS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W77-05930

THE FISH POPULATIONS OF THE MIDDLE 340 KM OF THE WABASH RIVER,
DePauw Univ., Greencastle, Ind. Dept. of Zoology.
J. R. Gammon.
Available from the National Technical Information Service, Springfield VA 22161 as PB-265 201, Price codes: A05 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center, West Lafeyette, Technical Report No. 86, December 1976. 73 p, 14 fig, 2 tab, 29 ref, 2 append. OWRT A-046-IND(1).

Descriptors: *Fish populations, *Distribution patterns, Electric shocking gear, Electro-fishing, *Indiana, Rivers, *Biomass, Water quality.
Identifiers: *Wabash River(Ind), *Shannon Diversity indice, Index of well-being, Moxostoma, Hog suckers, Hypentelium nigricans.

During 1973, 1974, and 1975 over 7000 fish were collected from 0.5-1.5 km long stations distributed throughout 340 km of the middle Wabash River. Sepcies distributions and several fish community parameters were examined, including relative density (no/km), relative biomass (kg/km), number of species captured per station, two Shannon diversity indices (based on numbers and weights), and two evenness indices based on the diversities. In addition, a composite index consisting of the sums of weighted relative density, weighted relative biomass, and the two Shannon indices of diversity was examined. The composite index was much less variable than any single community parameter and appeared to reflect water quality. The pattern of the composite indices indicated several problem areas in the Wabash River, especially downstream from Lafayette, Indiana, the Montezuma/Clinton area, and Terre Haute. Four species of Moxostoma and the hog sucker (Hypentelium nigricans) together appeared to reflect water quality better than any single species of fish.
W77-05935

OBSERVATIONS ON THE MYCOTIC FLORA IN THE PERIPHYTON OF THE TICINO RIVER, (IN ITALIAN),
Pavia Univ. (Italy). Instituto di Botanica.
For primary bibliographic entry see Field 2I.
W77-05971

SEASONAL VARIATION IN THE PLANKTON AND PERIPHYTON DIATOMS OF LAKE GEORGE, N.Y.,
Rensselaer Polytechnic Inst., Troy, N.Y. Fresh Water Inst.
S. L. Williams, and N. L. Clesceri.
Report FWI 72-17, 1970. 39 p. 7 fig., 2 tab., 31 ref. OWRT C-2209(3387)(4).

Descriptors: *Ice cover, *Diatom, *Succession, *Dominant organisms, Plankton, Periphyton, *New York, Lakes, Seasonal.
Identifiers: *Lake George(NY), Asterionella formosa, Asterionella minutissima, Fragilaria capucina, Fragilaria crotonensis, Syndra tenera, Cyclotella.

Diatoms were identified and counted in plankton and artificial substrate periphyton samples collected from Lake George, N. Y. between 1967-1971. There was usually little quantitative relationship between number of diatom species in plankton and periphyton. A plankton diatom maximum was consistently observed within six weeks after the dissipation of ice-cover. Periphyton diatoms did not have a similar maximum but had high standing crops throughout summer and fall and low standing crops in winter and spring. Plankton diatom populations showed a successful pattern. Asterionella formosa and Fragilaria crotonensis showed correlations with temperature in the spring/winter period. A. formosa was related to solar radiation in the fall; and Synedra tenera with soluble phosphorus. Dominant and subdominant diatom species were generally typical of those in northern oligotrophic-mesotrophic lakes. F. crotonensis dominance appears to be increasing in some seasons. Periphyton diatoms were at a minimum in summer-fall and had no well-developed maximum. A. minutissima was usually dominant and S. tenera subdominant. Total periphyton diatoms showed good correlation with temperature and solar radiation; Fragilaria capucina with temperature in winter-spring and fall; A. minutissima standing crops were correlated with solar radiation and temperature in the south lake basin and temperature in the north; and S. tenera with temperature and solar radiation some years. (Buchanan-Davidson--Wisconsin)
W77-05984

A STUDY OF THE PHYTOPLANKTON OF THE LOT RIVER, (IN FRENCH),
Toulouse Univ. (France). Lab. of Hydrobiology.
A. Dauta.
Ann Limnol 11(3), p 219-238, 1975.

Descriptors: *Phytoplankton, Rivers, Biomass, *Diatoms, Flow, Growth rates, Seasonal, *Algae, Analytical techniques, *Microscopy.
Identifiers: *Euchlorophyceae, France, *River , Lot(France).

The phytoplankton of the River Lot was studied in relation to physical-chemical factors at 23 stations from July 1972-July 1973. The geographical, hydrological and physical-chemical characteristics of the river are briefly described. The densty the algal populations was estimated by counting samples by the inverted-microscope technique. A list of the principal species is given. Most of these species frequently occur in oligotrophic to beta mesosaprobic environments. The drift of alae was assessed; the mean percentage of cells in suspension was about 10%. Diatoms and Euchlorophyceae formed over 90% of the biomass which varied from 0.7 g/m3 in winter to 9 g/m3 in summer. The annual cycle was practically the same as that recorded in temperate lakes. The effects of the physical, chemical and biological components on the growth of the algae is discussed. NO2 phosphates and slilca did not appear to be limiting factors. The summer development of the algae was associated with the weak flows in the canalized river.--Copyright 1976, Biological Abstracts, Inc.
W77-06005

INVERTEBRATES AND ORGANIC MATTER SWEPT ALONG DURING SPATES, AT THE INLET AND OUTLET OF THE KARSTIC SYSTEM OF BAGET, (IN FRENCH),
Toulouse Univ. (France). Lab. of Hydrobiology.
For primary bibliographic entry see Field 5B.
W77-06007

GAS BUBBLE DISEASE,
Washington State Dept. of Fisheries, Seattle.
J. W. Wood.
In: Diseases of Pacific Salmon, Their Prevention and Treatment, State of Washington Department of Fisheries, Hatchery Division, Second Edition November, 1974, p. 53-54.

Descriptors: *Atmospheric gases, *Supersaturation, Nitrogen, *Fish diseases, *Fish hatcheries, *Aquiculture, Fish larvae, Juvenile fish, Salmon, Trout, Fish eggs, Fish physiology, Water supply, *Fishkill, Dissolved oxygen, Methodology, Water quality.
Identifiers: *Gas bubble disease, *Nitrogen supersaturation, Van Slyke determination, Yolk sac fry, Fingerling and yearling salmon, Adult salmon.

Of excess atmospheric gases possible in supersaturated water, nitrogen is least tolerated by fish. Excess nitrogen may result from several causes: (1) air entering the intake side of a pump and being forced into solution by the pressure of the pump, (2) air entering the intake of a gravity water line, or at a point along the line, and being forced into solution by the gravity head on the line, (3) plunge pools in the water system at the base of waterfalls, or at the base of dam spillways, where air bubbles are carried to depth in the pool and forced into solution by the water pressure, (4) air domes, under pressure, overlaying subterranean water will force excess air into solution. Spring and well waters are notoriously low in oxygen and high in nitrogen. (Katz)
W77-06018

GAS BUBBLE DISEASE IN ADULT CHINOOK SALMON,
Washington State Dept. of Fisheries, Seattle.
R. L. Westgard.
In: Northwest Fish Culture Conference, December 5-6, 1963, Tumwater, Washington, p 98.

Descriptors: *Salmon, Fish hatchery, *Mortalities, Bioassay, On-site observation, *Nitrogen, Supersaturation, *Animal pathology, Freshwater, Water quality, Water analysis, Columbia River, *Chinook salmon.
Identifiers: *Adult chinook salmon, *Blinded fish, *Gas bubble disease, Nitrogen supersaturation, Van Slyke analysis.

Eighty-eight percent of the blinded adult chniook salmon impounded at the McNary Spawning Channel died. Gas bubbles were observed in the aqueous humor of their eyes. Nitrogen content of the cascading water was 119%. No symptoms were observed in fish held in water of 104-107%. (Katz)
W77-06020

ANALYSIS OF DISSOLVED NITROGEN IN FISH BLOOD,
Brit'sh Columbia Univ., Vancouver. Inst. of Fisheries.
For primary bibliographic entry see Field 5A.
W77-06022

U-TUBE OXYGENATION FOR ECONOMICAL SATURATION OF FISH HATCHERY WATER,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
R. C. Speece.
Transactions of the American Fisheries Society, Vol 98, p 789-795, 1969. 2 tab, 8 fig.

Descriptors: *Methodology, *Water supply, Saturation, *Fish hatchery, *Dissolved oxygen, Water quality, *Atmospheric gases, Hydrostatic pressure, Ventilation, Aquiculture.
Identifiers: *Air blower injection modification, *Venturi air injection.

The U-Tube oxygenation process is described with particular application made to saturation of fish hatchery waters. In U-Tube oxygenation, the water is directed down into a chamber about forty feet deep, under a baffle and then rises back to the surface. Air bubbles are injected just beneath the surface as the water starts downward. The downward velocity of the water is designed to be from three to ten feet per second. This is sufficient to drag the air bubbles along with the water down underneath the baffle. The hydrostatic head pressurizes the bubbles making it possible to saturate or supersaturate water in one pass through the U-Tube. A U-Tube installation has been operating continuously for over a year at a Federal fish hatchery. It utilizes a free fall of three feet to entrain sufficient air bubbles to 100% saturate a flow of 300 gallons per minute with no external power requirements. (Katz)
W77-06023

DISSOLVED GAS SATURATION ANOMALIES AND EXCESS HELIUM IN THE OCEAN,
Scripps Institution of Oceanography, La Jolla, Calif.
For primary bibliographic entry see Field 5A.
W77-06024

EFFECTS OF GAS SUPERSATURATION ON SALMON IN THE COLUMBIA RIVER,
Corvallis Environmental Research Lab., Oreg. Western Fish Toxicology Station.
G. R. Bouck.
Presented at Ecological Society of America Symposium, Minneapolis, Minnesota, August 30, 1972. 22 p, 48 ref, append.

Descriptors: *Supersaturation, *Columbia River, *Salmon, Rainbow trout, *Fish physiology, *Fish diseases, Animal pathology, *Anadromous fish, Nitrogen, Oxygen, Fish migration, Fish passage, Fish behavior, Review, Bibliographic, Spillway, Dams, Dam sites, Chinook salmon.
Identifiers: *Gas bubble disease, *Nitrogen supersaturation.

The physiological and ecological effects of gas supersaturation on fish, especially salmon in the Columbia River are presented. Gas bubble disease of fish is similar to bends suffered by divers and is caused by excessive hyperbaric total dissolved gas pressure and is not caused by dissolved nitrogen gas alone. A supersaturated water will not form bubbles unless the total dissolved gas pressure exceeds the atmospheric pressure plus hydrostatic and other opposing pressures. The pathological effects of gas bubble disease on salmon and its effect on the Columbia River salmon fishery are presented in detail. (Katz)
W77-06026

NITROGEN AND FISH, DEFINITION OF FISHERY PROBLEMS CAUSED BY NITROGEN SUPERSATURATION,
Oregon Fish Commission, Salem.
R. W. Schoning.
Presented at Tri-State Governor's Meeting, Nitrogen Supersaturation Problem in the Columbia and Snake Rivers, Portland Oregon, March 23, 1971, 10 p.

Descriptors: *Oregon, *Columbia River, *Chinook salmon, Anadromous fish, Rainbow trout, Commercial fish, Fish diseases, *Supersaturation, *Dams, Hydroelectric power, Fish physiology, Fish behavior, *Fish migration, *Mortality, On-site investigations.
Identifiers: *Gas bubble disease, *Nitrogen supersaturation, Snake River.

The effects of gas supersaturation on the salmonid fish in the Columbia River are described. The effect of this condition on their numbers is presented. The nature of gas bubble disease is discussed. The levels of supersaturation and related mortalities and the actions to resolve the problems are given. (Katz)
W77-06027

USE OF A RECOMPRESSION CHAMBER TO ALLEVIATE GAS-BUBBLE DISEASE IN COHO SAC-FRY,
New Hampshire Univ., Durham.
For primary bibliographic entry see Field 8I.
W77-06028

BONNEVILLE SPILLWAY NITROGEN TESTS, 29-30 OCTOBER 1972 TEST RESULTS,
Corps of Engineers, Portland, Oreg. Hydraulic Design Section.
For primary bibliographic entry see Field 8I.
W77-06029

FINAL REPORT, THE EFFECT OF SPILLWAY FLOW DEFLECTORS AT BONNEVILLE DAM ON TOTAL GAS SUPERSATURATION AND SURVIVAL OF JUVENILE SALMON,
National Marine Fisheries Service, Seattle, Wash.
R. C. Johnson, and E. M. Dawley.
December 1974, 18 p. 2 tab, 3 fig, 5 ref. Contract No DACW-57-74-F-0122, Army Corps of Engineers.

Descriptors: *Columbia River, Dams, Dam sites, *Spillways, *Nitrogen, Supersaturation, Juvenile fish, Fish migration, *Fish passages, Salmon, On-site investigations, *Mortality, *Chinook salmon.
Identifiers: Fish survival, *Nitrogen supersaturation.

To reduce the atmospheric gas supersaturation of water passing over the Columbia River dams, a spillway design termed 'flip lip' was examined for effect on dissolved gases. Described are the gas content of waters at various flows through standard and modified spillways and success of passage of juvenile chinook salmon through a standard and modified spillway. Modified spillways did not adversely affect the survival of juvenile fall chinook salmon passing through the spillways. (Katz)
W77-06030

EVALUATION OF ALTERNATIVE FISH BARRIER SYSTEMS FOR PILGRIM NUCLEAR POWER STATION,
Yankee Atomic Electric Co., Westborough, Mass. Environmental Sciences Group.
For primary bibliographic entry see Field 8I.
W77-06032

SATURATION VALUES OF DISSOLVED GASES ASSOCIATED WITH THE OCCURRENCE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT,
Duke Power Co., Charlotte, N.C.
W. D. Adair, and J. J. Hains.
In: Thermal Ecology (Gibbons, J.W. and R.S. Sharitz, Eds.) 1974, Proceedings of Symposium, Augusta, Georgia, May 3-5, 1973, Atomic Energy Commission, p 59-76, 7 tab, 2 fig, 19 ref.

Descriptors: *Fish disease, *Thermal power, *Thermal pollution, *Thermal stress, Thermal water, *Supersaturation, Dissolved oxygen, Nitrogen, Water pollution effects, Water quality, Fresh water fish, Fish physiology, *Environmental effects.
Identifiers: *Nitrogen, Supersaturation, *Gas-bubble disease, Dissolved nitrogen, Duke Power Company, Plant Operating Data.

This study was initiated after the discovery of gas-bubble disease in fish inhabiting a cove that received the heated effluent from a steam electric station. During the winter of 1971-1972, the concentrations and the corresponding dissolved-oxygen and -nitrogen saturation values associated with the heated effluents from three Duke Power Company steam stations were determined. The N2 supersaturation in the discharge area at Marshall Steam Station was generally equal to or higher than that obtained in the discharge areas of two other steam stations. At Marshall the N2 supersaturation was highest at the point of discharge, but it returned to near control or below 110% levels at station 3.0 km downstream; O2 was supersaturated at the point of discharge only from January to March. The withdrawal of intake water under a skimmer wall did not result in higher than control saturation values at the plant intake structure. (Katz)
W77-06034

OCULAR OXYGEN CONCENTRATIONS ACCOMPANYING SEVERE CHRONIC OPTHALMIC PATHOLOGY IN THE LAKE TROUT (SALVELINUS NAMAYCUSH),
Michigan State Univ., East Lansing. Dept. of Physiology.
J. R. Hoffert, M. B. Fairbanks, and P. O. Fromm.
Comparative Biochemistry and Physiology, Vol 39A (1971), p 137-145, 2 tab, 2 fig, 16 ref.

Descriptors: *Fish diseases, *Fish physiology, *Animal pathology, Fish behavior, Mortalities, Fish hatchery, *Lake trout, *Animal biochemistry, Laboratory tests, Methodology, Dissolved oxygen, Supersaturation, Radiation.
Identifiers: *Opthalmic pathology, *Hatchery diseases, *Ocular oxygen concentration, Gross pathology, Ocular tissue, Frequency of pathology, Pseudobranch.

Ocular oxygen tensions of 359 plus or minus 31.9(37) mm Hg were found in normal lake trout eyes while those eyes showing gross pathology had a significantly lower PO2 of 219 plus or minus 34.4(27). The progression of the ocular histopathology is described in relationship to pseudobranch degeneration. The maintenance of elevated intraocular PO2 even in the presence of chronic opthalmic pathology is noted. (Katz)
W77-06035

THEORETICAL CONSIDERATION OF THE CAUSE OF GAS-BUBBLE DISEASE IN FISH IN A HEATED EFFLUENT,
New York State Public Service Commission, Albany.
P. A. Isaacson.
New York Fish and Game Journal, Vol 24, No 1, January, 1977. p 95, 4 ref.

Descriptors: *Fish disease, *Fish physiology, Animal pathology, Biochemistry, *Water temperature, Supersaturation, Marine fish, *Thermal powerplants, Laboratory tests, Effluents, Thermal pollution, Heated water.
Identifiers: *Gas bubble disease, *Cold water, Tiger barbs, Barbus spp, Pop-eyes.

The hypothesis is presented that gas supersaturation is a necessary condition for gas-bubble disease, but the disease is triggered by cold stress. Observation of tiger barbs subjected to cold stress showed a high incidence of pop-eye, a symptom of gas bubble disease. (Katz)
W77-06036

FINAL REPORT, STUDIES ON EFFECTS OF SUPERSATURATION OF DISSOLVED GASES ON FISH,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
E. Dawley, T. Blahm, G. Snyder, and W. Ebel.
Performed for Bonneville Power Admin., Bureau of Reclamation, Army Corps of Engineers, September 1975. 84 p, 15 tab, 26 fig, 20 ref.

Descriptors: Salmon, Anadromous fish, *Fish physiology, Fish behavior, Migration, Bioassays, Laboratory tests, *Chinook salmon, Rainbow trout, Biochemistry, Oxygen, *Nitrogen, *Fish diseases, *Supersaturation, *Columbia River, Dams, Water quality, Rainbow trout, Methodology, On-site investigations.
Identifiers: *Detection, *Avoidance, Intermittent exposures, Shallow tank tests, *Physiological effects, Fish strains, Blood chemistry, Lateral line, Oxygen/nitrogen ratio, Depth distribution.

The results of research in gas supersaturation conducted by the National Marine Fisheries Service during 1972-1973 are summarized. Details are given of research regarding detection and avoidance, intermittent exposure to supersaturated water, bioassays, depth distribution of salmonids, physiological effects and the effects of oxygen/nitrogen ratio. (Katz)
W77-06037

OCCURRENCE OF GAS BUBBLE DISEASE SYMPTOMS ON FISH IN MID-COLUMBIA RIVER RESERVOIRS,
Public Utility District of Grant County, Ephrata, Wash.
M. B. Dell, M. W. Erho, and B. D. Leman.
September, 1973. 48 p, 11 tab, 16 fig, 5 ref.

Descriptors: *Columbia River, *Fish disease, *On-site investigations, Anadromous fish, Freshwater, *Methodology, Fish behavior, *Fish populations, Fishing, *Fishing gear, *Reservoirs, Water quality, Dissolved oxygen, Freshwater fish, Monitoring, Suckers, Chinook salmon, Sockeye salmon.
Identifiers: *Gas bubble disease, *Dissolved gas monitoring, *Mid-Columbia dams, *Gas bubble disease symptoms, Squawfish, Chiselmouth, Peamouth, Coho salmon, Mid-Columbia River.

Over 30,000 anadromous and resident fish were examined for Gas Bubble Disease (GBD) symptoms in the mid-Columbia River region during the 1974 spill season (May-August). Types of gear employed to capture fish included Lake Merwin trap, beach seine, Pennsylvania trap and angling. For the study period, only 3,221 fish out of 32,289 examined had GBD symptoms (10.0%). Game fish numbered 3,016 (mostly salmonids) and 4.2% had GBD symptoms. Resident fish (non-game) numbered 29,273 and 10.6% had GBD symptoms. Ranking of presence of GBD symptoms in fish from highest to lowest percentage by method of capture was as follows: for salmonids, Lake Merwin trap, beach seine, Pennsylvania trap; for resident species (game and non-game), Lake Merwin trap, Pennsylvania trap, beach seine, angling. (Katz)
W77-06038

BONNEVILLE SPILLWAY NITROGEN TESTS, 29-30 OCTOBER 1972, SUMMARY OF RESULTS,
Corps of Engineers, Portland, Oreg. Hydraulic Section.
H. P. Tervooren.
11 December 1972, 2 p.

Descriptors: *Dams, Dam sites, *Spillways, Atmospheric gas, Saturation, *Supersaturation, Hydraulics, *Columbia River, *Bonneville Dam, Forebays, Engineering structures, On-site investigations.
Identifiers: *Nitrogen supersaturation, Deflector tests, Forebay nitrogen, *Deflector efficiency, Low spill conditions.

Tests at the Bonneville Dam indicate that for future Bonneville spill conditions with 100% saturation in the forebay, the nitrogen level in the spillway tailrace would not exceed 110% if deflectors are installed in all bays. (Katz)
W77-06039

BONNEVILLE SPILLWAY TEST DEFLECTOR INSTALLATION IN BAY 18. PRELIMINARY EVALUATION REPORT ON NITROGEN TESTS,
Army Engineer District, Portland, Oreg. Hydraulic Section.
H. P. Tervooren.
9 June 1972, 8 p., 1 fig.

Descriptors: *Dams, Dam sites, *Spillways, Atmospheric gas, Saturation, *Supersaturation, Hydraulics, *Columbia River, *Bonneville dam, Efficiency of forebays, Engineering structures, On-site investigations.
Identifiers: *Nitrogen supersaturation, *Deflector tests, Forebay nitrogen supersaturation, *Deflector efficiency, Low spill conditons, Median spill conditions.

A series of tests were conducted to define dissolved nitrogen conditions under low spill conditions and to provide a comparison of deflector results with identical conditions prior to installation of the test deflectors. Studies were also made of deflector efficiency when forebay saturation levels were 112% to 118%. Test results indicate that deflectors remove about half of the surplus of dissolved nitrogen. The nitrogen content of the Bonneville forebay is dependent upon upriver spill conditions. (Katz)
W77-06040

PLANKTONIC PROTOZOANS OF THE VOLGA-BALTIC WATER SYSTEM, (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
N. V. Mamaeva, and S. I. Mazheikaite.
Gidrobiol Zh 11(5), p 81-85, 1975.

Descriptors: Plankton, *Protozoa, Seasonal, Rivers, Lakes, Benthic fauna.
Identifiers: *Codonella-cratera, *Coleps-hirtus, *Strobilidium-velox, *Tintinnidium-fluviatile, USSR, *Lake Kishemskoe(USSR), Volga-Baltic water systems, *Kubena River(USSR).

The Volga-Baltic waterway and North Dvina system (USSR) are diverse in their origin and hydrologic conditions. The protozoan fauna has certain common features and peculiarities Tintinnidium fluviatile, Codonella cratera, Strobilidium velox and Coleps hirtus, which are characteristic for the summer season, predominate in all of them. The protozoans of the Kubena River emptying into Lake Kubenskoe differed considerably from those in the lake. The protozoans of lakes Kishemskoe and Zaulomskoe were diverse. Despite the fact that these lakes are connected and close to one another, their species composition differed noticeably. The protozoans of the artificial canal constructed at the site of the Kovzha and Vytegra rivers and Novoinkinskoe reservoir are represented by 2 very minute species. In Lake Onega the species composition of protozoans was diverse, but their abundance was low. The maximum density of protozoans was noted in Lake Kishemskoe.--Copyright 1976, Biological Abstracts, Inc.
W77-06090

CHIEF JOSEPH SPILLWAY NITROGEN ENTRAINMENT, TEST OF 17 NOVEMBER, 1972,
For primary bibliographic entry see Field 8I.
W77-06099

5D. Waste Treatment Processes

DISPERSION PROCESSES IN CIRCULAR OPEN-CHANNEL FLOWS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 8B.
W77-05601

BARRIER FUNCTION OF WATERPIPE INSTALLATIONS, (IN RUSSIAN),
G. P. Zarubin, and Y. V. Novikov.
Gig Sanit 4, p 72-79, 1976.

Descriptors: *Waste water treatment, Water purification, *Organoleptic properties, *Industrial wastes, Ozone, Chlorination, Coagulation, Filtration, Activated carbon, Flocculation, Toxicity, Pesticides, Pipelines.
Identifiers: Carcinogens, Barrier function(Water pipes).

Purification of water from petroleum products; Kaprolaktam production waste; organic, inorganic and heterocyclic compounds; pesticides; carcinogenic hydrocarbons; surfactants; phenols; and industrial pollutants with limited organoleptic toxicity index by settling, chlorination, coagulaton, filtration, carbonation, ozonization and flocculation is reviewed. A limited barrier function of water installatins for the above substances was established in most cases. Adherence to permissible pollutant concentrations in water reservoirs used for centralized drinking water supplies is cautioned. (Possible effects on humans are mentioned.–Copyright 1976, Biological Abstracts, Inc.
W77-05643

FREEZER, VACUUM, OVEN SEWAGE TREATMENT SYSTEM,
Raymond Lee Organization, Inc., New York. (Assignee).
V. D. De Tola.
U.S. Patent No. 3,985,086, 3 p, 2 fig, 4 ref; Official Gazette of the United States Patent Office, Vol 951, No 2, p 530, October 12, 1976.

Descriptors: *Patents, *Sewage treatment, *Sewage disposal, *Waste water treatment, Water pollution treatment, Waste disposal, Freezing, Freeze drying, Vacuum drying, Incineration.

The invention provides a sewage treatment system which eliminates the necessity for sewer lines, facilitates the conversion of sewage and waste into useful by-products, is not polluting to the atmosphere, permits constructive use of lands now limited by sewage requirements and ecological regulations, reclaims water, and may be added to existing sewage plants to dispose of sludge which is presently buried or dumped at sea. It produces land fill material, may be adapted to industrial units for cleaning industrial smoke and solids, facilitates separate salvage, compaction, shredding, and the like of solid waste which cannot be processed such as paper and metals, and is incorporatable as individual building or house units. Methane gas may be reclaimed and compressed and concentrated by the system of the invention. Raw sewage, garbage, waste are ground in a grinder and impeller and supplied under pressure to a freezer and vacuum chamber. The water is drawn off by vacuum and waste matter is suppled by compressed air and gas pressure to an electronic oven when it is reduced to ash. The entire sewage treatment system of the invention may be housed in a compact small volume housing or container so that it is readily available for installation in individual houses or buidlings. (Sinha-OEIS)
W77-05653

METHOD FOR REMOVING METALS FROM DILUTE AQUEOUS SOLUTIONS,
Texaco Inc., New York. (Assignee).
F. C. McCoy.
U.S. Patent No. 3,985,554, 4 p, 7 ref; Official Gazette of the United States Patent Office, Vol 951, No 2, p 688, October 12, 1976.

Descriptors: *Patents, *Water quality control, Water pollution control, *Water purification, *Separation techniques, Industrial wastes, *Metals, Heavy metals, Chemical reactions, Iron, Mercury, Aqueous solutions, Waste water treatment.
Identifiers: *Metals recovery.

The object of the invention is to provide a method for substantially and inexpensively reduce the concentration of gold, mercury, copper, tin and other metals below iron in the electromotive series from dilute aqueous solutions containing these metals. The method comprises passing a solution containing one or more of the metals in the form of uncomplexed ions over a bed of iron powder and maintaining contact until the desired reduction in concentration of the metal or metals is obtained. The iron powder used is deoiled swarf from ferrous metal grinding operations. The heavy metal is then recovered by whatever chemical means is appropriate for the metal involved. In the area of environmental protection, this process is useful for removing small amounts of water-soluble Sn, Pb, Cu, or Hg compounds from plant effluents. It should be noted that for every atom of metal moved from the water, an atom of soluble Fe is released into the column effluent. However, iron is usually less objectionable than the metal which replaces it. This is particularly true of mercury. (Sinha-OEIS)
W77-05654

METHOD AND SYSTEM FOR PURIFYING LIQUID,
Almag Pollution Control Corp., Baltimore, Md. (Assignee).
A. J. Casolo.
U.S. Patent No. 3,985,648, 8 p, 2 fig, 2 tab, 7 ref; Official Gazette of the United States Patent Office, Vol 951, no 2, p 712, October 12, 1976.

Descriptors: *Patents, *Water purification, *Waste water treatment, *Industrial wastes, *Water quality control, Separation techniques, Filtration, Ion exchange, Cation exchange, Anion exchange, Resins, Hydrogen ion concentration.

A method and system combines filtration and ion-exchange structures for removing contaminants from liquids. In overall concept, contained liquid is passed through filtering mediums to remove particulate matter. Organics are removed from the liquid by passage through adsorbent non-ionic type resins. The liquid is then passed through strong acid cation exchange resins, weak base anion exchange resins, weak acid cation exchange resins, and strong base anion exchange resins arranged in a predetermined location in the liquid flow path to provide optimized contaminant removal. One of the optimization techniques is through the pH adjustment of the liquid at predetermined points in the flow path. Additionally, The liquid to be purified is passed through mixed bed polisher resins as well as chelation resins to provide a final substantially contaminant free liquid which is returned to use in a closed loop fashion. (Sinha-OEIS)
W77-05655

METHOD OF TREATING WASTEWATER WITH FLOWABLE FLOCCULANTS,
Swift and Co., Chicago, Ill. (Assignee).
J. R. Newman.
U.S. Patent No. 3,985,651, 4 p, 5 ref; Official Gazette of the United States Patent Office, Vol 951, no 2, p 714, October 12, 1976.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Water purification, Separation techniques, *Flocculation, Coagulation.
Identifiers: *Flocculants, Polyacrylamides.

Polyacrylamides and other polymeric compounds of high molecular weight are widely used as flocculants for the treatment of water in order to agglomerate and separate out suspended particles. Commercial use of dry flocculants has proved to be inconvient and excessively time-consuming. This invention provides a flowable flocculant having finely ground polyacrylamides dispersed within a water soluble polyhydric alcohol carrier having a relatively low molecular weight and within which the flocculating agent will not dissolve to any appreciable extent. The product is flowable at room temperature. The prepared fluidized flocculant may be pumped and metered into an aqueous system to accomplish desired flocculation. (Sinha-OEIS)
W77-05656

RECOVERY OF CHROMATES BY MEMBRANE,
Monsanto Co., St. Louis, Mo. (Assignee).
T. A. Orofino.
U.S. Patent No. 3,986,950, 4 p, 4 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 1153, October 19, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution control, Industrial water, Cooling water, *Membrane processes, Cooling towers, Inhibitors, Corrosion, Scaling, Water pollution sources, Chromium, Hydrogen ion concentation, Membranes.
Identifiers: Blow-down streams, Chromate salts recovery.

A method for separating and recovering hexavalent chromium containing salts from process water waste is described. The invention pertains to a method for recovering the chromates which are present in cooling tower blow-down stream as corrosion inhibitors and transferring these valuable materials to the incoming make-up water. Moreover, the cooling tower blow-down is rendered environmentally acceptable for discharge into sewers and waterways. The method is a selective dialysis of chromates through the walls of hollow fiber membrane assemblies. Preferential transport of chromate is achieved through pH adjustment of the chromium containing waste water. The method includes adjusting the pH to a level of less than 4.0 to shift the ionic equilibrium in favor of forming undissociated chromic acids. Following pH adjustment, the blow-down water is brought into contact with the exerior walls of a multiplicity of open-ended, continuous hollow fibers which are permeable to undissociated chromic acids while cooling tower make-up water is simultaneously passed through the interiors of the hollow fibers. Upon passage through the walls and into the hollow interior of the fibers, the permeating species is colleced in the circulating cooling tower make-up water for further use in the cooling process in corrosion inhibition. (Sinha-OEIS)
W77-05661

TREATMENT OF WASTE ROLLING OIL,
Interlake, Inc., Chicago, Ill. (Assignee).
V. D. Beaucaire.
U.S. Patent No. 3,986,953, 5 p, 1 fig, 6 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 1154, October 19, 1976.

Descriptors: *Patents, *Waste water treatment, *Water pollution control, *Water pollution treatment, *Waste disposal, Oily water, Iron, Water purification, Hydrogen ion concentration, Oxygen, Filtration.
Identifiers: Steel industry, Magnetite.

In industry, a considereable amount of oil is used during the cold rolling operation and must be disposed of periodically. An additional operation in the production of steel strapping or sheeting is

the pickling of the steel with a hydrochloric acid bath. The waste pickle liquor, which contains iron ions also presents a disposal problem. The object of this invention is to provide a process for treating an oil and water emulsion, comprising mixing it with an acid solution containing iron ions to break the oil and water emulsion. The pH of the solution is adusted to a value in the range of from about 7 to about 12 and mixing oxygen with it to produce magnetite particles for absorbing the oil. The magnetite and absorbed oil are separated from the solution by filtration to produce a clarified solution. (Sinha-OEIS)
W77-05663

METHOD AND APPARATUS FOR CLARIFYING CONTAMINATED LIQUIDS,
George (A.L.), Inc., Lafayette, Ind. (Assignee).
A. L. George, and J. C. Manning.
U.S. Patent No. 3,986,954, 15 p, 7 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 1154, October 19, 1976.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution control, *Separation techniques, Suspended solids, Pollutants, Gases, Pressure, Equipment, Specific gravity.

A method and apparatus for clarifying aqueous liquids containing suspended contaminants which do not readily respond to gravitational separation alters and increases the specific gravity differential between the aqueous liquid and the suspended contaminants. The method comprises forming a flowing stream of aqueous liquid and contaminants in a gas-liquid mixing zone under pressure at a desired flow velocity. A stream of gas is also passed into the mixing zone to intimately dispese and dissolved into the liquid phase to form a multiphase gas-contaminant-liquid stream. The flow velocity is then increased along with a substantially simultaneous decrease in pressure to finely disperse the gase. The flow velocity is then decreased with a simultaneous increase in pressure. The abrupt alternate fluctuation of stream flow velocity and pressure results in a highly homogeneous multiphase mixture. The mixture is next passed into a zone having an increased volume flow area which is maintained at a reduced pressure to cause the dissolved gas to break out of solution and form finely dispersed gravity-density reducing microscopic bubble which attach to themselves and to the suspended contaminants to increase the specific gravity differential between the contaminants and liquid. The contaminants are thus caused to separate and float to the surface of the liquid. As the flow velocity is reduced it allows the formation and separation of a contaminant layer floating on the surface of the liquid which can then be separated. (Sinha-OEIS)
W77-05664

EFFLUENT WASTE TREATMENT PROCESS AND APPARATUS,
Sphere, Inc., Bedford, N.Y. (Assignee).
A. Plicque.
U.S. Patent No. 3,986,955, 7 p, 3 fig, 12 ref; Official Gazette of the United States Patent Office, Vol 951, No 3, p 1155, October 1976.

Descriptors: *Patents, *Waste water treatment, *Water reuse, Water quality control, Water pollution control, Water purification, Water vapor, Condensation, Electric currents, Recycling.

Raw liquid waste from a self contained unit, such as a group of dwelling units or a ship or industrial plant is treated in order to utilize the liquid portion for recycle and re-use. The process comprises passing an electric current, preferably off peak current, through the liquid waste to convert the water content to water vapor, thereby sterilizing the total body of the waste, followed by utilization of the vapor and its sensible and latent heat for recycle and re-use. When applied to systems which are large users of power and water and which discharge large quantities of liquid wastes, the process of this invention will result in both environmental and economic advantages. The process is preferably continuous and may use automatic circulating means. It may be staged in one or more stages and pressurized for more efficient utilization of heat. The residual purified solid content is dried if to be used for fertilizer. (Sinha - OEIS)
W77-05665

PURIFICATION OF WASTE WATERS FROM THE MANUFACTURE OF RAG PULP-CONTAINING PAPER (OCHISTKA STOCHNYKH VOD OT PROIZVODSTVA BUMAGI S ISPOL' ZOVANIEM TRYAPICHNOI POLUMASSY),
Ukrainskii Nauchno-Issledovatelskii Institut Bumagi, Kiev (USSR).
V. A. Kovba, V. P. Svitel'skii, R. P. Ptitsa, L. G. Ponomareva, and T. D. Sokirko.
Bumazhnaya Promyshlennost, No. 11, p 23-24, November, 1976. 2 fig.

Descriptors: *Pulp wastes, *Waste water treatment, Chemical precipitation, Wastes, Industrial wastes, Waste treatment, Water pollution sources, Pulp and paper industry, Effluents, Water pollution control, Water pollution treatment, Pollutants, *Water purification, Lime.
Identifiers: *Pulp washing, Rag pulps, Aluminum sulfate, Iron sulfate, Polyacrylonitrile.

Because of the relatively small amount of rag pulp produced, recovery of chemicals is uneconomical, and the spent liquors are usually discharged. However, effluents from pulp washing contain a considerable amount of pollutants, depending on the pulping method, type of rags used, and other factors. The degree of pollution of these effluents varies from day to day, requiring continuous adjustments of chemicals for their purification. A study conducted at several mills producing cigarette paper has shown that the main factor governing the amount and variations of pollutants in the effluents is the method of pulp washing. Compared to washing in digesters, washing in a hollander gives a more uniform effluent. This method is recommended. Other recommendations are (1) maximum utilization of excess paper ma chine white water and bleaching waters for pulp washing, (2) pooling of effluents from various batches to equalize their composition, and (3) purification with the use of chemicals (such as aluminum sulfate, polyacrylonitrile, ferrous sulfate, and lime). (Stapinski-IPC)
W77-05683

THE CONSUMPTION OF WATER IN THE PAPER INDUSTRY (I1 CONSUMO D'ACQUA NELL'INDUSTRIA CARTARIA),
For primary bibliographic entry see Field 3E.
W77-05684

BIOLOGICAL POSSIBILITIES FOR WASTE WATER PURIFICATION (CONSIDERATII ASUPRA POSIBILITATILOR BIOLOGICE DE PURIFICARE A APELOR REZIDUALE),
For primary bibliographic entry see Field 5G.
W77-05685

WASTE TREATMENT ADVANCES: THE UNOX PROCESS,
Union Carbide Corp., South Charleston, W. Va.
R. W. Gross, Jr.
Chemical Engineering Progress, Vol 72, No 10, p 51-56, October, 1976. 1 fig, 2 illus, 6 tab.

Descriptors: *Oxygenation, *Waste water treatment, *Industrial wastes, Pulp wastes, Wastes, Waste treatment, Water pollution treatment, Water pollution sources, Operation and maintenance, Pulp and paper industry, Effluents, Chemical industry, Oil industry, Color, Biochemical oxygen demand, Hydrogen ion concentration, Suspended solids, Nutrients, Treatment facilities.

In the Unox waste water treatment system developed by Union Carbide Corp., waste water, recycle sludge, and purified oxygen are fed to the first stage, and both gaseous and liquid phases flow concurrently through the reaction system and exit the last stage, at which point the activated sludge is separated from the final effluent through conventional clarification. The reactor is generally a rectangular tank divided into reaction stages by internal walls having individual passages for liquid and vapor flows. Oxygen can be supplied by pipeline (limited to treatment plants in the proximity of an oxygen generating facility), by on-site generating plants (cryogenic or pressure-swing-adsorption plants), or by a liquid oxygen storage and vaporization facility. The benefits of the Unox process are listed and the safeguards built into the system to prevent a buildup of hydrocarbons and oxygen in the contained space above the mixed liquor are discussed. The operating parameters of four full-scale Unox plants at Nissho Kakayu Co. (petrochemical facility in Oita, Japan), Gulf Stages Paper Corp. (Tuscaloosa, Alabama), Union Carbide Corp.'s production facilities at Sisterville, W. Virginia, and American Cyanamid's Lederle Laboratories at Pearl River, N.Y., are described. At Gulf States Paper Corp., the total treatment process consists of primary clarification, nutrient addition, Unox secondary treatment, tertiary flocculation, and clarification for color removal. The system treats 8.7 million gal/day of effluent having a BOD of 149 mg/liter and a pH of 6.6. The system removes 87% of the BOD. The treated effluent has a BOD of 20 mg/liter and suspended solids of 79 mg/liter. (Witt-IPC)
W77-05686

CLOSED-CYCLE UTILIZATION OF FERMENTATION INDUSTRY EFFLUENTS (ZAMKNUTYI TSIKL ISPOL'ZOVANIYA OTKHODOV GIDROLIZNOGO PROIZVODSTVA),
Kirovskii Biokhimicheskii Zavod (USSR).
M. I. Kukushkin.
Gidroliznaya i Lesokhimicheskaya Promyshlennost, No 7, p 22-23, 1976. 1 fig.

Descriptors: *Waste water treatment, *Water reuse, *Water conservation, *Chemical industry, Water pollution control, Wastes, Industrial wastes, Water pollution sources, Biological treatment, Activated sludge, Yeasts, *Recycling, Industrial water, Biochemical oxygen demand, Fermentation, Distillation, Hydrolysis, Byproducts, Feeds.
Identifiers: *Fermentation industry, Closed systems, Furfural.

A closed system for the utilization of fermentation industry wastes has been introduced recently at the Kirov Biochemical Factory in the USSR. These wastes comprise the residual liquor from fermentation, furfural distillation residue, and condensate from residual liquor evaporation. Of the 90 cu m of residual liquor formed daily during thickening of the yeast, about 43 cu m is reused for dilution of the nutrient medium. The remainder goes to biological oxidation equipment; the activated sludge is separated to be mixed with yeast suspension prior to separation of the cells, while the oxidized residual liquor is evaporated and used as an admixture of the hydrolysis liquor. A part of the condensate is used also in the preparation of the hydrolysis liquor, while the remainder goes to the water recycling system. The advantages of the system as well as some drawbacks (scaling of heat exchangers, etc.) are discussed. The excess condensate, which has a 5-day BOD of 150-400 mg oxygen/liter, should undergo biological purification before being directed to the water recycling system. (Stapinski-IPC)
W77-05689

LIME TREATMENT OF SULFITE PULP MILL BLEACHERY EFFLUENT (CISTENI ODPADNICH VOD Z BELENI SULFITOVE BUNICINY VAPNEM),
IRAPA, Prague (Czechoslovakia). Vyvojovy a Racionalizacni.
D. Ruzickova.
Papir a Celuloza, Vol 31, No 10, p 220-224, 1976. 4 fig, 19 ref, 5 tab.

Descriptors: *Bleaching wastes, *Waste water treatment, *Lime, *Chemical oxygen demand, Pulp wastes, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Suspended solids, Europe, Foreign countries, Sludge, Hydrogen ion concentration, Calcium carbonate, Chemical precipitation, Sedimentation, Biological treatment, Pulp and paper industry.
Identifiers: Calcium oxide, Czechoslovakia, Sulfite pulp mills.

Effluent discharge regulations in Czechoslovakia specify not only allowable levels of suspended solids and BOD, but also pose a limit on COD. In the case of a bleached sodium sulfite pulp mill, laboratory tests showed that biological treatment alone could not reduce the COD level sufficiently. Therefore, a study was carried out to find a suitable pretreatment method which would substantially reduce the COD of sulfite pulp bleachery effluents. Laboratory tests showed that COD reductions ranging from 42.6 to 52.7% could be achieved with 10 g of calcium oxide/liter. The sludge could be thickened to 15%, using 50 g/cu m of Praestol 2935 filtration aid. After liming, the effluent has a pH of 12.5 and had to be saturated with flue gas to pH 10.5 to precipitate calcium carbonate. After sedimentation of the precipitate, the effluent was again saturated with flue gas to a neutral pH suitable for biological treatment. (Trubacek-IPC)
W77-05693

NEW SLUDGE-DEWATERING PRESS MAKES ITS DEBUT AT GLATFELTER (PAPER MILL).
Pulp and Paper, Vol. 50, No. 14, p 146, December, 1976. 1 fig, 1 illus.

Descriptors: *Pulp wastes, *Sludge treatment, *Dewatering, *Equipment, Sludge, Pulp and paper industry, Wastes, Waste treatment, Water pollution sources, Water pollution treatment, Industrial wastes, Solid wastes.

Papermaking effluent sludge at P.H. Glatfelter Co. (Pennsylvania) is being dewatered on a Tait-Andritz sludge-dewatering machine. Cake dryness from the unit is 35-40% solids. Filtrate analyses showed better than 95% capture, and polymer requirements were lower than expected at about 1-2 lb/ton of solids. These results are being attained without full use of the unit's pressing section. The pressing section is being operated at minimum pressure because of a concern that knots, stones, or other large hard objects will puncture the plastic wires. A solution to this problem is being sought, to arrive at the anticipated final dryness of 40-45% solids. The unit is currently operated at a 50-60 ton/day rate. (Witt-IPC)
W77-05695

BIOLOGICAL OXIDATION OF CONCENTRATED HIGH-YIELD BISULFITE SPENT LIQUOR,
Quebec Univ., Trois-Rivieres.
S. N. Lo, J. J. Garceau, I. Wusungu, and G. Pineault.
Pulp and Paper Canada, Vol. 78, No. 1, p 69-74 (T19-T24), January, 1977. 10 fig, 26 ref, 3 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Sulfite liquors, *Activated sludge, Wastes, Industrial wastes, Waste treatment, Water pollution treatment, Water pollution sources, *Biological treatment, Biochemical oxygen demand, Pulp and paper industry, Effluents, *Aeration.
Identifiers: Spent sulfite liquors, Sulfite pulp mills, High yield pulping.

A completely mixed activated sludge process was applied to the treatment of high-yield bisulfite waste liquor containing 6-15% solids. In addition to evaluating the feasibility of the biological treatment, other objectives were to analyze the influence of the hydraulic residence time and the concentration of mixed liquor volatile suspended solids on the process behavior, and to evaluate the design and kinetic parameters of the process. The results clearly show the possibility of biologically treating the high-yield spent sulfite liquor at high solids concentrations, with 55-85% 5-day BOD removal in a single stage. In order to meet Canadian antipollution regulations, further studies of the process or the utilization of a two-stage process will be required. (Brown-IPC)
W77-05696

NEW ELECTROFLOCCULATING PROCESS FOR TREATING INDUSTRIAL WASTE WATERS (NUOVO PROCEDIMENTO PER IL TRATTAMENTO DELLE ACQUE RESIDUE INDUSTRIALI CON ELETTROFLOCCULAZIONE),
Societa Degremont (Italy).
J. M. Rovel.
Quaderni Istituto Ricerca Acque, Vol. 31, p 251-261, 1975. 5 fig, 3 tab.

Descriptors: *Waste water treatment, *Flocculation, *Industrial wastes, Wastes, Waste treatment, Water pollution treatment, Water pollution sources, Colloids, Coagulation, Oxidation, Reduction(Chemical), Color, Pulp and paper industry, Effluents, Pulp wastes, Biodegradation, Capital costs, Operating costs.

The 'Electro M' process for coagulation and flocculation of colloidal material from industrial waste waters is described. As a result of secondary oxidation-reduction reactions, a portion of the soluble impurities is also attacked, resulting in secondary effects, such as the breaking up of long molecules. This can facilitate biodegradation and decoloring of the effluents. While investment costs for the system are high, operating costs are low. In addition, the system incorporates the advantages of high flexibility, simplified automation, and easily handled sludge. Detailed descriptions are given of industrial applications of the process, including use in a paper mill. Treatment of effluent from a mill producing colored papers is shown to result not only in good fiber and filler recovery, but also in almost complete decoloration. (Speckhard-IPC)
W77-05697

PURIFICATION OF WASTE WATERS FROM WET BARKING (RENING AV AVLOPPSVATTEN FRAN VATBARKNING),
IVL-Konsult A. B., Stockholm (Sweden).
H. Norrstrom, L. Widell, and G. Akerlund.
Svensk Papperstidning, Vol. 80, No. 2, p 45-49, February 10, 1976. 4 fig, 9 ref, 2 tab. English summary.

Descriptors: *Bark, *Waste water treatment, *Wood wastes, *Water pollution control, Pulp and paper industry, Effluents, Wastes, Industrial wastes, Water pollution sources, Separation techniques, Sedimentation, Pulp wastes, Sludge treatment, Sludge disposal, Waste disposal, Solid wastes.
Identifiers: *Barking effluents, Closed systems, Woodrooms(Pulp mill).

Effluents of hydraulic barkers can contribute considerably to the total discharges of a pulp mill. Various possibilities of decreasing this effluent volume have been studied, and comparative results are presented for different alternatives, viz., mechanical and physical separation of bark and other solids, notably by sedimentation vs. flotation, and closure of the waste water system. Problems of bark and sludge handling and disposal are indicated. (Brown-IPC)
W77-05698

NEW IN-PLANT TECHNOLOGY TO REDUCE POLLUTION FROM A SODIUM BASE SULPHITE MILL,
MoDoCell A. B., Ornskoldsvik (Sweden).
R. Brannland, R. Gustafsson, and B. Hultman.
Svensk Papperstidning, Vol. 79, No. 18, p 591-594, December 20, 1976. 9 fig, 8 ref, 1 tab.

Descriptors: *Pulp wastes, Water pollution control, *Bleaching wastes, Recirculated water, Biochemical oxygen demand, Chlorides, Air pollution, Sulfite liquors, Pulp and paper industry, Neutralization, Evaporation, Water pollution sources, Industrial wastes, Wastes, Water conservation, Effluents, *Water reuse, Waste water treatment.
Identifiers: *Sulfite pulp mills, Pulp washing, Chemical recovery, Closed systems.

The Mo och Domsjo sulfite mill at Domsjo (Sweden) produces annually 230,000 metric tons of bleached pulp and uses the Stora process for chemical recovery from the spent sulfite liquor. Internal methods to reduce both air and water pollution have been developed and effectively reduced effluent BOD from 90 kg/ton in 1970 to 25 kg/ton in 1976. These steps include selective chloride removal from the closed cooking chemical cycle, flue gas scrubbing, neutralization of the spent sulfite liquor prior to evaporation, a new bleach sequence with recovery of the alkaline extraction effluent, and integration of the first bleaching stage and screening into the unbleached pulp washing and recovery systems. These measures are described in some detail and demonstrate that a modern sodium-base sulfite mill can achieve environmental standards at least equivalent to those of a modern kraft mill. (Brown-IPC)
W77-05699

THE PAPER INDUSTRY'S ENVIROECONOMICS,
L. R. Ember.
Environmental Science and Technology, Vol. 10, No. 10, p 978-979, October, 1976. 1 fig, 1 illus.

Descriptors: *Water pollution control, *Air pollution, *Pulp and paper industry, *Costs, Capital costs, Operating costs, Economics, Waste water treatment, Water pollution treatment, Administrative costs, Fixed costs, Energy, Pollution abatement, Fuels.
Identifiers: Kraft mills, Sulfite pulp mills.

The costs to the paper industry to curb process-related air and water pollution are discussed. A recent survey by the National Council for Air and Stream Improvement found that environmental protection expenditures represented more than 30% of the total capital expenditures of $1,700,000,000 by U.S. pulp, paper, and paperboard manufacturers. In 1975, total capital expenditures for environmental protection amounted to $645,000,000, up about 19% from 1974 expenditures of $523,000,000. Estimated costs to operate environmental protection facilities for 1975 totaled $248,000,000 (this includes energy, labor, and maintenance costs, and payment to public agencies for treatment in muncipal systems, where applicable). Fixed costs, administrative costs, and research expenditures amounted to $457,000,000. These annual charges translate to $10.50 for environmental protection per ton of paper produced in 1975, up almost 17% from 1974. The operation of abatement equipment in 1975 alone required the additional (over 1974) consumption of 3200 billion Btu's; this additional energy represented 0.3% of the industry's fossil fuel and purchased energy consumption in 1975. Costs for environmental protection systems at an old mill (Crown Zellerbach Corp.'s Camas, Washington, kraft-sulfite mill) and

at a new mill (Mead Corp.'s Escanaba, Michigan, kraft mill) are discussed and compared. (Witt-IPC)
W77-05700

ENVIRONMENTAL PROTECTION COSTS IN THE SWEDISH PULP AND PAPER INDUSTRY (MILJOVARDSKOSTNADER I SVENSK MASSA-OCH PAPPERSINDUSTRI),
Svensk Papperstidning, Vol. 80, No. 2, p 35-37, February 10, 1977. 5 tab.

Descriptors: *Pulp and paper industry, *Water pollution control, *Air pollution, *Economics, Foreign countries, Europe, Waste water treatment, Capital costs, Operating costs, Costs, Pollution abatement, *Treatment facilities.
Identifiers: *Sweden, Scandinavia.

A questionnaire rearding capital investments in pollution-control and environmental protection facilities was answered by 89% of all Swedish pulppaper and wood fiberboard mills, corresponding to 95% of Swedish production capacity. During 1971-1975, such investments totaled 1070 million Swedish crowns, of which 286 million represented federal support. By categories, internal water purification required 620 million, external water treatment 260 million, air purification 130 million, and research and control apparatus 60 million crowns. Environmental expenditures accounted for 14% of the pulp and paper industry's total capital investments (7600 million crowns). Operating costs of environmental installations were 80 million crowns in 1975 alone. Ecology investments for 1976-1980 were reportedly planned by 88% of respondents corresponding to about 90% of planned capacity, totaling 1760 million crowns (not counting inflation), of which about 50% will go for internal, 25% for external water quality control, 10% for air quality control, and the rest for unspecified measures. These environmental protection investments will probably consume 15% of the industry's total capital projects for 1976-1980. (Kaustinen-IPC)
W77-05701

REMOVAL OF COLOR AND ORGANIC MATTER FROM KRAFT PROCESS BLEACH EFFLUENTS,
F. M. A. Nicolle, J. A. Histed, and K. V. Nayak.
Canadian Patent No. 992706. July 13, 1976, 23 p, 3 fig, 8 tab, 9 claims.

Descriptors: *Bleaching wastes, *Waste water treatment, *Color, *Organic compounds, *Patents, Wastes, Industrial wastes, Water pollution sources, Water pollution treatment, Pulp and paper industry, Hydrogen ion concentration, Chemical precipitation, Lime, Pulp wastes, Effluents, *Organic matter.

A method for removing color from pulp bleaching effluents (particularly from effluents from the bleaching of kraft pulp) comprises (1) separately concentrating caustic extraction effluent and chlorination effluent, (2) combining the concentrating effluent to form a mixture having a pH below 3 so as to obtain a precipitate which removes at least part of the color of the combined effluent, and (3) separating the remaining effluent from the precipitate. The separated effluent may be contacted with lime to precipitate additional color material. (Lynch-IPC)
W77-05702

METHOD OF PURIFYING THE WASTE WATER OF PAPER MILLS,
Feldmuhle Anlagen- und Produktionsgesellschaft M. B. H., Duesseldorf-Oberkassel (West Germany). (Assignee).
V. Franzen, T. Ploetz, U. Haupt, and E. Solich.
United States Patent No. 3,998,731. December 21, 1976, 6 p, 2 fig, 8 claims.

Descriptors: *Pulp wastes, *Waste water treatment, *Patents, *Biochemical oxygen demand, Wastes, Industrial wastes, Waste treatment, Organic compounds, Lignins, Hydrogen ion concentration, Water pollution sources, Water pollution treatment, Water pollution control, Pulp and paper industry, Effluents, Adsorption.
Identifiers: Aluminum oxide.

A method of reducing the BOD of pulp and paper mill effluents containing organic contaminants, including lignin, comprises contacting granular activated gamma-alumina with the effluents at pH 2.2-3.0 until the contaminants are adsorbed on the alumina, and then separating the effluents from the alumina. The pH can be adjusted to the required level by adding mineral acid such as HC1. (Lynch-IPC)
W77-05703

PURIFICATION OF WASTE WATER FROM SULFATE PULP BLEACHING PLANTS,
Uddeholms A. B. Skoghall (Sweden). (Assignee).
B. G. Broddevall.
United States Patent No. 3,990,969. November 9, 1976, 5 p, 1 fig, 11 claims.

Descriptors: *Bleaching wastes, *Waste water treatment, *Color, *Patents, *Pulp wastes, Chemical precipitation, Pulp and paper industry, Effluents, Water pollution sources, Wastes, Industrial wastes, Lignins, Hydrogen ion concentration, Anion exchange, Ion exchange, Separation techniques, Waste treatment, Chlorine, Water pollution control, Water pollution treatment.
Identifiers: Black liquors, Kraft mills.

A process is provided for decoloring an aqueous effluent from the bleaching of kraft pulp with chlorine or chlorine-containing compounds, the effluent containing dark-colored lignin degradation products, and the bleaching system including at least one alkali-extraction stage. The process consists of (1) mixing the aqueous effluent from an alkaline extraction stage with sufficient acid (e.g., sulfuric acid, HC1, etc) to reduce the pH of the effluent to no more than 2, thus forming a precipitate of dark-colored lignin degradation products and other organic material, (2) separating the acidic aqueous effluent from the precipitate, (3) dissolving the separated precipitate by contact with an alkaline solution composed at least partially of black liquor from the pulping process, and (4) passing the acidic aqueous effluent separated from the precipitate through a bed of particulate phenolic anion-exchange resin having pendant secondary or tertiary amino groups. The resin is activated by the acidic effluent and acts to bind the residual dar-colored lignin degradation products to permit separating a decolored effluent from the resin bed. (Lynch-IPC)
W77-05704

WATER REUSE IN 100% SECONDARY FIBRE PULPING MILL,
Brown Co., Eau Claire, Wis.
T. A. Badar.
TAPPI Secondary Fibers Conference Papers, Los Angeles, September 20-23, 1976, (Preprinted Proceedings, TAPPI, Atlanta, Ga.), p 31-35. 2 fig.

Descriptors: Pulp and paper industry, *Water reuse, *Waste water treatment, *Pulp wastes, Flocculation, Silica, Wastes, Industrial wastes, Polymers, Suspended solids, Biochemical oxygen demand, Wisconsin, Reclaimed water, Water conservation, Effluents, Water quality control, Water pollution control, Water pollution treatment, Water conservation.
Identifiers: *Waste paper, Aluminum sulfate, Tissue paper, Deinking.

The Absorbent Products Division of Brown Co. (Eau Claire, Wis.) produces sanitary tissue from 100% deinked waste paper pulp. In a primary stage 10,000,000 gal/day of deinking waste water are treated with 120-150 ppm of alum at pH 6.0-6.5 and an anionic polymer (not identified). Flocculation was improved by the addition of 10-15 ppm of activated silica (prepared separately from sodium silicate). The treatment removed 94-95% of suspended solids and 50-60% of the BOD to produce discharges from the mill within the 1977 Permit Standards of purity. Up to 9 million gal/day are recycled through the mill and up to 4 million gal/day will be treated in a secondary treatment plant under construction. (Dickey-IPC)
W77-05705

TREATMENT OF EFFLUENT FROM SECONDARY FIBRE MILLS,
Van Luven Consultants Ltd., Montreal (Quebec).
R. van Soest.
TAPPI Secondary Fibers Conference Papers, Los Angeles, September 20-23, 1976, (Preprinted Proceedings, TAPPI, Atlanta, Ga.), p 9-21. 4 fig, 6 ref, 1 tab.

Descriptors: *Pulp wastes, *Waste water treatment, Pulp and paper industry, *Effluents, Wastes, *Industrial wastes, Waste treatment, Water pollution sources, Hydrogen ion concentration, Water temperature, Costs, *Chemical oxygen demand, *Biochemical oxygen demand, Carbohydrates, Suspended solids, Sludge, *Sludge disposal, Sewage lagoons, Landfills, Incineration, North America.
Identifiers: Waste paper.

Ninety-one paper mills in the U.S.A. and Canada produced 13,220 tons/day of secondary fiber (1975) or 6% of the total fiber (all types) produced. The effluents from the production of secondary fiber contain small fibers, sand, grit, filler clays, pitch, colloidal solids, and dissolved soilds, generally at high pH and temperature. Many operations utilize municipal treatment facilities, with industry paying its full share of treatment costs. The composition and properties of several typical effluents are tabulated. Primary and secondary treatments were found to yield COD/BOD ratios of 1.5-1.8, meaning that 80-90% of the organics in pulp and paper mill effluents are equally easy to biodegrade, due mainly to carbohydrate components. Eventually suspended solids are recovered as sludge which may be disposed of by lagoon and landfill or by incineration. Ultimately the treatment of mill wastes requires compact processes, built on the mill site and operated by production personnel to assure acceptable costs. (Dickey-IPC)
W77-05706

PROCEEDINGS OF SEMINARS ON WATER POLLUTION ABATEMENT TECHNOLOGY IN THE PULP AND PAPER INDUSTRY.
Environmental Protection Service, Ottawa (Ontario).
Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, 220 p. March, 1976.

Descriptors: *Pulp and paper industry, *Technology, *Water pollution control, *Pulp wastes, Legislation, Suspended solids, Biological treatment, *Waste water treatment, Waste treatment, Fish, Toxicity, Water pollution effects, Effluents, Sludge, Dewatering, Sludge treatment, Water pollution sources, Wastes, Water pollution treatment, *Pollution abatement.

This volume contains 7 contributions by different experts on regulations and waste characterization; suspended solids removal; biological waste treatment; fish toxicity of mill effluents; physical-chemical effluent treatment; sludge dewatering and handling practices; and specialized internal practices for water pollution abatement in pulp and paper mills. These seminars have been held at Ottawa, Ontario (May 1-2), Moncton, New Brunswick (May 5-6), and Prince George, British Columbia (May 21-22, 1975). (See W77-05709 thru W77-05715) (Brown-IPC)

W77-05708

REGULATIONS AND WASTE CHARACTERIZATION,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5G.
W77-05709

SUSPENDED SOLIDS REMOVAL,
C. H. Rimmer.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 15-34, March, 1976. 12 fig.

Descriptors: *Pulp wastes, *Suspended solids, *Waste water treatment, *Treatment facilities, Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Bark, Screens, Flotation, Settling basins, Gravity, Waste treatment, Effluents.
Identifiers: Kraft mills, Groundwood mills, Newsprint mills, Spills, Savealls, Clarifiers.

Theoretical and practical aspects of in-plant and external processes and facilities for controlling suspended solids discharged from pulp and paper mills are reviewed, including wood preparation (barking), kraft screen room, groundwood newsprint, and kraft recausticizing systems; spills and washup; screens and flotation savealls; settling ponds, gravity clarifiers, and flotation clarifiers. (See also W77-05708) (Brown-IPC)
W77-05710

BIOLOGICAL WASTE TREATMENT,
Department of the Environment, Ottawa (Ontario). Wastewater Technology Centre.
B. E. Jank.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 35-80, March, 1976. 14 fig, 31 ref, 4 tab.

Descriptors: *Pulp wastes, *Biological treatment, *Waste water treatment, Operation and maintenance, Temperature, Hydrogen ion concentration, Toxicity, Nutrients, Oxygen requirements, *Activated sludge, Aerated lagoons, Oxidation lagoons, Trickling filters, Pulp and paper industry, Effluents, Water pollution sources, Wastes, Industrial wastes, Waste treatment, Design.
Identifiers: Clarifiers.

This presentation provides fundamental information on the operation of biological effluent treatment systems, including design principles, general parameters (temperature, pH, toxicity, nutrient requirements, oxygen requirements), specific processes (activated sludge and modified activated sludge treatments, aeration tanks and clarifiers, aerated stabilization basins, waste stabilization ponds, trickling filters, and rotating biological contactors), and specific applications of biological treatment facilities to pulp and paper mill effluents. (See also W77-05708) (Brown-IPC)
W77-05711

FISH TOXICITY WITH SPECIFIC REFERENCE TO THE PULP AND PAPER INDUSTRY,
For primary bibliographic entry see Field 5C.
W77-05712

PHYSICAL-CHEMICAL TREATMENT (OF INDUSTRIAL WASTE WATERS),
Pulp and Paper Research Inst. of Canada, Pointe Claire (Quebec).
A. Wong.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 125-169, March, 1976. 20 fig, 131 ref, 5 tab.

Descriptors: *Waste water treatment, *Industrial wastes, Operation and maintenance, Adsorption, Ion exchange, Foam fractionation, Coagulation, Flocculation, Membrane processes, Dialysis, Electrodialysis, Reverse osmosis, Oxidation, Separation techniques, Carbon, Foam separation, Color, Water pollution treatment, Water quality control, Waste treatment, Water pollution control.
Identifiers: Ultrafiltration.

This discussion compares the capabilities of biological with physical-chemical effluent treatment processes and outlines the basic available techniques (general principles, operating parameters, and practical applications). Techniques described include adsorption, ion-exchange, adsorptive bubble separation (foam fractionation), coagulation, flocculation, membrane separation (dialysis, electrodialysis, reverse osmosis, ultrafiltration), and chemical oxidation. Three practical detoxification processes reviewed are the Pulp and Paper Research Institute of Canada carbon treatment, granular carbon adsorption, and foam separation. Numerous studies on decolorization technologies are also summarized. (See also W77-05708) (Brown-IPC)
W77-05713

SLUDGE DEWATERING AND HANDLING PRACTICES IN THE U.S. PAPER INDUSTRY,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
For primary bibliographic entry see Field 5E.
W77-05714

SPECIALIZED INTERNAL PRACTICES (FOR POLLUTION ABATEMENT),
D. A. Kelly.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 195-220, March, 1976. 6 fig.

Descriptors: *Pulp and paper industry, *Water pollution control, Wastes, Effluents, Water reuse, *Waste water abatement, Water quality control, Recycling, Bleaching wastes, *Pollution abatement.

The two extreme philosophies of pulp and paper mill designs reprsent (1) total integration or (2) total separation of effluent-control and production processes. The effluent-free mill discharging only gaseous and solid wastes exemplifies the former, while the latter attempts to optimie production economics as such, relying on comprehensive external treatment for environmental protection. Neither extreme is commercially represented; all existing mills employ numerous special designs and operating features to meet ecology standards while maximizing profit potentials. In-plant process (pulping, bleaching, papermaking) modifications for effluent quality control involve specific solutions to fit given local conditions. Some general practices of effluent recycling and reuse in various plant departments and different mills are outlined, including woodroom, kraft continuous and batch digesters, brown stock washing-screening-cleaning, kraft chemical recovery, sulfite mill, mechanical pulp mill, and bleach plant. (See also W77-05708) (Brown-IPC)
W77-05715

BIOLOGICAL DEGRADATION OF DIFFICULT-TO-OXIDIZE EFFLUENT COMPONENTS (BIOLOGICHESKAYA DESTRUKTSIYA TRUDNOOKISLYAENYKH KOMPONENTOV STOCHNYKH VOD),
M. A. Lomova, and R. M. Ryabkova.
Bumazhnaya Promyshlennost, No. 11, p 24-26, November, 1976. 3 fig, 1 tab.

Descriptors: *Pulp wastes, *Lignins, *Biodegradation, *Waste water treatment, Chemical oxygen demand, Biochemical oxygen demand, Bacteria, Microorganisms, Wastes, Waste treatment, Industrial wastes, Water pollution sources, Pulp and paper mills, Effluents, Kinetics.
Identifiers: Kraft mills.

A study was made of the degradation of lignin in kraft mill effluents that had been subjected to biological purification in aeration tanks. Graphs are presented showing the kinetics of COD and 5-day BOD reduction and of bacterial growth during the 72-hr experiments. Following an initial period of 12-20 hr, during which the residual easily oxidized substances were degraded, active degradation of lignin began, accompanied by substantial reductions of COD and BOD. The growth curve of the microorganisms showed an initial decrease of total numbers, followed by rapid growth of bacteria able to utilize lignin as a sole source of carbon. The additionally purified effluents required only 5-10 fold dilution before being discharged, as compared to a 30-40 fold dilution needed for effluent purified by the conventional process in aeration tanks. (Stapinski-IPC)
W77-05716

INCREASING THE BIOLOGICAL VALUE OF ACTIVATED SLUDGE (POVYSHENIE BIOLOGICHESKOI TSENNOSTI AKTIVNOGO ILA),
G. G. Litvinov, G. I. Samodanova, and M. A. Lomova.
Bumazhnaya Promyshlennost, No. 10, p 24-25, October, 1976. 1 fig, 1 tab.

Descriptors: *Activated sludge, *Fermentation, *Sludge treatment, *Waste treatment, Proteins, Bacteria, Ultrasonics, Hydrolysis, Enzymes, Nitrogen, Chemical degradation, Wastes, Water pollution sources, Sludge, Solid wastes, Byproducts, Feeds.
Identifiers: Pepsin, Chymopsin(Trypsin + chymotrypsin).

It has been shown earlier that activated sludge from fermentation plants can be used as a vitamin supplement for animal feed. However, the assimilability of the bacterial protein has not been investigated. This is the subject of the present report. The activated sludge was treated with ultrasonic waves, and its hydrolysis before and after treatment by pepsin and chymopsin (a mixture of trypsin and chymotrypsin) was investigated. After a 7-minute treatment, up to 75% of the nitrogen was solubilized by the digestive enzymes, compared to 20% for untreated sludge. The maximum effect of the ultrasonic treatment was obtained with 8 micrometer waves. (Stapinski-IPC)
W77-05717

SPILLWAYS WITH NOTCHED OVERFLOW EDGE (VODOSLIVY S ZUBCHATOI PERELIVNOI KROMKOI),
For primary bibliographic entry see Field 8B.
W77-05718

ADDITION OF POWDERED ACTIVATED CARBON TO ACTIVATED SLUDGE REACTORS,
Connecticut Univ., Storrs. Inst. of Water Resources.

H. E. Klei, and D. W. Sundstrom.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 887, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, March 1977. 41 p, 2 tab, 27 fig, 4 ref. OWRT A-057-CONN(1), 14-31-0001-5007.

Descriptors: *Activated carbon, *Activated sludge, Control, *Laboratory tests, *Adsorption, Organic loading, Phenols, Economic efficiency, *Waste water treatment.
Identifiers: *Powdered activated carbon, *Periodic addition, *Activated sludge reactors, *Aeration vessel, *Effluent quality improvement, *Total organic carbon, Toxic feeds, Glucose substrates, Impulse and step inputs.

Continuous addition of powdered carbon to the aeration vessel of an activated sludge plant has been shown to improve the quality of the effluent stream. Periodic addition of powdered carbon, however, may provide a more practical and economical method to reduce normal peaks in diurnal loads and to control unexpected changes in the entering feed. In this laboratory study, activated sludge reactors were subjected to a variety of feed upsets and powdered carbon was applied as a control mechanism. With glucose as the substrate, addition of carbon only slightly moderated concentration changes during the transient period but decreased the steady state total organic carbon concentrations significantly. Phenol impulses up to 1000 mg/l and phenol steps up to 250 mg/l did not have adverse long-term effects on the bacteria whereas a phenol step of 1000 mg/l killed the culture. For impulse inputs of phenol, the simultaneous addition of carbon greatly reduced the magnitude of the transient changes in concentration. With step inputs of phenol, carbon addition rapidly lowered the phenol concentration in the reactor and permitted continuous operation with inlet phenol concentrations above 1000 mg/l. (de Lara-Connecticut)
W77-05723

PREPARATION AND EVALUATION OF IMMOBOLIZED SINGLE AND MULTIPLE ENZYME SYSTEMS,
Nebraska Univ., Lincoln. Dept. of Food Science and Technology.
For primary bibliographic entry see Field 3E.
W77-05724

A COMPARISON OF INACTIVATION OF BACTERIOPHAGE AND ENTEROVIRUS DURING ACTIVATED SLUDGE TREATMENT,
New Mexico State Univ., University Park. Dept. of Biology.
J. S. Glass.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 902, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, March 1976, 52 p, 6 fig, 14 tab., 30 ref, 1 append. OWRT A052-NMEX(2).

Descriptors: *Viruses, *Bacteriophage, *Activated sludge, *Waste water treatment, Domestic wastes, Diseases, Dialysis, Water pollution, Microbiology, Environmental sanitation, Sewage, Aerobic treatment.
Identifiers: *Enterovirus, *Poliovirus T-1, *Coxsackievirus B-1, Dialysis membrane chambers, Inactivation.

Inactivation of indigenous baceriophages was followed during an extended-aeration activated sludge treatmenet of domestic sewage. A bacteriophage was isolated from the sewage and used to follow the inactivation of phages contained inside a dialysis membrane chamber immersed in an activated sludge aeration reactor. inactivation of Poloovirus T-1 and coxackievirus B-1 contained inside immersed memberane chambers was followed. Statistical comparisons showed no detectable difference between phage inactiation reate constance measured in the aeration reactors and in the immersed changers. No significant differences were detercted between inactivation rate constants for poliovirus T-1 and Coxasckievirus B-1 and no significant differences were detected between inactiation rate constants for phage and enteroviruses inside immersed chambers. The results suggest that immersed dialysis membrane chambers may provide an accurate, reliable method for measuring virus inactivation during activated sludge treatment, and that bacteriophages may provide a convenient indicator system for virus inactivation during this process. (Hain-New Mex State)
W77-05726

THE PERFORMANCE OF ACTIVATED SLUDGE PLANTS COMPARED WITH THE RESULTS OF VARIOUS BACTERIAL TOXICITY TESTS - A STUDY WITH 3, 5-DICHLOROPHENOL,
Hoeschst A. G., Frankfurt am Main (West Germany).
B. Broecker, and R. Zahn.
Water Research, Vol. 11, p. 165-172, 1977. 1 tab, 10 fig, 12 ref.

Descriptors: *Activated sludge, *Sewage treatment, *Toxicity, *Phenols, Water pollution effects, Water treatment, Laboratory tests, Aquatic microbiology, Aquatic bacteria, *Sewage bacteria, Pseudomonas, Waste water treatment, Pollutant identification.
Identifiers: *3, 5-Dichlorophenol, *LC50, Shock loads.

It was investigated whether and to what extent the results obtained by various methods of determining bacterial toxicity in waste water could be applied to conditions prevailing in activated sludge plants or in receiving water. 3, 5-Dichlorophenol (DCP) was studied as an example of a persistent chemical which constitutes a pollution risk to water. The bacterial toxicity limits determined by five different methods - respiration after a 20-h consumption period, consumption rate after 2-h incubation, dehydrogenase activity determined with TTC, gas formation in a fermentation tube and inhibition of the cell division of Pseudomonas - all agreed with the toxicity limit of 5 mg DCP 1-1 found in degradation tests in laboratory activated sludge equipment. No safety margin need be taken into account when the test results are applied to biological purification plants. In the activated sludge plants the degradation of the industrial waste water was markedly impaired only when the DCP concentration was increased to 25 mg 1-1. This varied in degree according to the sludge load at the beginning of the trial. Shock loads of DCP did not cause the expected fall-off in degradation but only a moderate fluctuation in its rate. The decline in degradation following continuous and also discontinuous addition of DCP was largely or completely overcome within a few weeks by the bacteria becoming adapted to DCP. (Katz)
W77-05886

CARBON FILTER FOR REMOVING THERAPEUTANTS FROM HATCHERY WATER,
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
For primary bibliographic entry see Field 5C.
W77-05892

COMMENT ON 'AN OPTIMIZATION MODEL FOR REGIONAL WATER QUALITY MANAGEMENT' BY JOHN R. MCNAMARA,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 5G.
W77-05919

GOAL PROGRAMMING MODEL FOR WATER QUALITY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
A. B. Bishop, R. Narayanan, W. J. Grenney, and P. E. Pugner.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE2, Proceedings paper No. 12883, p 293-306, April 1977. 4 fig, 7 tab, 9 ref.

Descriptors: *Waste water treatment, *Water quality control, *Multiple purpose, *River basins, *Planning, Management, Optimization, Streams, Standards, Regions, Costs, Mathematical models, Equations, Systems analysis.
Identifiers: *Goal programming, *Computer programming, Cost minimization, Municipal regions, Water uses, *Multiple objectives.

The broad goals of the Federal Water Pollution Control Act Amendments (PL 92-500) and the regional nature of water quality plans require that multiple objectives be considered in planning. Goal programming is an extension of linear (or integer programming where the objective is to minimize the deviations from a set of goals, subject to systems constraints. A goal programming model is applied to an example river basin system where the planning goals are the quality levels of four constituents required or three desired beneficial water uses in five stream reaches, and the budget availability in four municipal regions for financing wastewater treatment. The model solution indicates the combination of treatment levels and costs that minimizes deviations from user quality and budgetary goals for all stream reaches. Values of deviation variables in the solution indicate the water quality levels achieved. A comparison with the minimum cost solution for meeting stream standards identifies the costs and tradeoffs of achieving higher user quality goals. (Bell-Cornell)
W77-05925

ADVANCED METHODOLOGIES FOR DESIGN OF STORM SEWER SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
B. C. Yen, H. G. Wenzel, Jr., L. Mays, and W. H. Tang.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 174, Price codes: A11 in paper copy, A01 in microfiche. Illinois Water Center, Urbana, Research Report No. 112, 224 p., 31 fig., 23 tab., 59 ref, 7 append. OWRT C-4123(No.9023) (8).

Descriptors: Synthetic hydrology, Methodology, *Design storm, Costs, Cost analysis, Drainage systems, *Dynamic programming, Effluents, Flood damage, Flood routing, Hydraulic design, Hydraulics, Mathematical models, Methodology, Operations research, Optimization, Risks, Safety factors, *Sewers, *Storm drains, Storm runoff, Systems analysis, Urban drainage, Urban runoff, Risks.
Identifiers: *Design(Hydraulics), Hydrograph routing, Probability analysis.

Described is the development of a series of computer models capable of determining the diameter, slope and crown elevations of each sewer in a storm drainage system in which the layout and manhole locations are predetermined. The criterion for design decisions is the generation of a least-cost system. The basis for all of the models is the application of discrete differential dynamic programming (DDDP) as the optimization tool. Two important concepts are introduced as optimal model components: hydrograph routing and risks and uncertainties in designs. Three routing procedures are adopted, each with its own advantages. Expected flood damage costs are evaluated through the analysis of numerous risks and uncertainties associated with the design. This analysis permits the estimation of the probability of

exceeding the capacity and the corresponding expected assessed damage of any sewer in the system. The expected damage cost is added to the installation cost to obtain the total cost which is then minimized in the DDDP procedure. Two example sewer systems are used as a basis for illustrating different aspects of the various least-cost design models and developing user guidelines.
W77-05927

OPTIMAL SIZE OF REGIONAL WASTEWATER TREATMENT PLANTS,
California Univ., Davis. Dept. of Civil Engineering.
W. H. Hovey, E. D. Schroeder, and G. Tchobanoglous.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 176, Price codes: A03 in paper copy, A01 in microfiche. California Water Resources Center, Davis, Technical Completion Report, Contribution No. 161, January, 1977. 36 p, 10 tab, 40 ref. (California Water Resources Center Project UCAL-WRC-W-476). OWRT-B-173-CAL(2).

Descriptors: *Waste water treatment, *Sludge treatment, *Effluents, Municipal wastes, Linear programming, *Activated sludge, Biological treatment, *Performance, Model studies, Regional analysis, Water quality.
Identifiers: *Regional treatment plants.

Activated sludge is the most commonly used treatment process for municipal wastewaters. Since 1950 a great deal of progress in understanding the biological and physical phenomena involved in the activated sludge process has occurred. In addition, a number of theoretical models have been developed to describe process performance. These models do not predict variation in process performance and current understanding of biological and physical factors does not explain why actual processes exhibit relatively wide variations in effluent quality. Prediction of process performance characteristics is increasingly important. Many metropolitan areas in the United States now have, or are planning, new regional wastewater treatment facilities. The objective of this study was to collect and analyze daily data over a twelve-month period from a significant number of activated sludge plants. Evaluation of effluent quality and effluent quality variation and effluent quality as a function of flow rate and design flow rate was done by linear and multiple regression techniques. Conclusions reached were that (1) effluent quality could be characterized as a function of mean annual values of the respective variables, (2) effluent quality was not a function of plant size, and (3) effluent quality had no correlation with effluent quality. (Snyder-California)
W77-05929

THE LOK ON PAI DESALTING PLANT - HONG KONG,
For primary bibliographic entry see Field 3A.
W77-05940

QUALITY CHARACTERISTICS OF URBAN STORM WATER IN SYDNEY, AUSTRALIA,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05963

TRACER MEASUREMENT OF REAERATION: III. PREDICTING THE REAERATION CAPACITY OF INLAND STREAMS,
Tsivoglou (E. C.) Inc., Atlanta, Ga.
For primary bibliographic entry see Field 5G.
W77-05977

MODELS IN BIOLOGICAL WASTEWATER TREATMENT: OBJECTIVES, RESULTS, APPLICABILITY,
Technische Hogeschool Twente, Enshede (Netherlands). Dept. of Chemical Engineering.
L. Lijklema.
In: Mathematical Analysis of Decision Problems in Ecology (Proceedings of the NATO Conference, Istanbul, Turkey, July 1973), Vol. 5 of Lecture Notes in Biomathematics. A. Charnes & W. R. Lynn, Eds., Springer-Verlag, Berlin, 1975, p 174-203. 7 fig, 1 tab, 71 ref.

Descriptors: *Waste water treatment, *Biological treatment, *Treatment facilities, *Water pollution control, *Model studies, *Activated sludge, Optimization, Equations, Systems analysis, Water purification, Performance.
Identifiers: Optimal performance.

Many attempts have been made to model different aspects of the processes in biological wastewater purification. Although not always clearly stated, the objective is generally that of optimizing the performance of a plant or a part of the plant. Sometimes the goal is better understanding of the processes. Aspects modeled concentrate particularly on the kinetics of waste removal and oxygen consumption. There exists a wide variety of models, from simple empirical types to complex conceptual models based on metabolism, growth kinetics, transport mechanisms, mass balances, and so forth. Whereas models based on empirical experience may be applied successfully within the limits set by past experience, an extension to new conditions generally will be impossible. However, the conceptual models will have a wider applicability, but the uncertainty of the relations involved and the difficulty of assessing the correct parameters limit the applicability and reliability. Presented is a review of mathematical models of the activated sludge process. The development, structure and application of these models are exemplified using a specific example. Important aspects are: population dynamics; energetics; reactors; and kinetics. (Bell-Cornell)
W77-05980

BIOLOGICAL FILTER DESIGN OPTIMIZATION,
Northwestern Univ., Evanston, Ill. Technological Inst.
H. B. Gotaas, and W. S. Galler.
In: Mathematical Analysis of Decision Problems in Ecology (Proceedings of the NATO Conference, Istanbul, Turkey, July 1973), Vol. 5 of Lecture Notes in Biomathematics. A. Charnes & W. R. Lynn, Eds., Springer-Verlag, Berlin, 1975, p 204-247. 10 fig, 3 tab, 18 ref, 2 append.

Descriptors: *Biological treatment, *Waste water treatment, *Design, *Trickling filters, Linear programming, Optimization, *Water quality control, Economic efficiency, Depth, Ventilation, Pumping, Biochemical oxygen demand, Constraints, Equations, Mathematical models, Systems analysis, Costs, Performance.
Identifiers: Optimum performance, Cost minimization, Performance efficiency, Recirculation.

An optimization method using linear programming is employed to determine the least-cost, most effective design for biological trickling filters based on four different models: the Eckenfelder, the Galler-Gotaas, the National Research Council and the Upper Mississippi and Great Lakes Board. Filter depth has the greatest influence on the most economical design with the Galler-Gotaas model, some influence in the Eckenfelder and NRC models, and no influence in the Upper Mississippi and Great Lakes model. The most economical design is achieved when the depth is maximum to permit adequate filter ventilation, after which recirculation is economical up to about four recirculations. The radius of the filter must then be increased to provide greater volume to achieve the required BOD removal. Design curves are shown for the four models. Because more variables are included in the Galler-Gotaas model, it appears to provide the best fit to treatment observations for different types of wastes. If pumping to the filters is necessary regardless of the filter depth, deeper filters with forced ventilation are more economical than shallower filters. (Bell-Cornell)
W77-05981

A GEOGRAPHICAL SYSTEMS ANALYSIS OF THE WATER DISPOSAL NETWORKS OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York. Dept. of Geography.
L. Zobler, G. W. Carey, M. R. Greenberg, and R. M. Hordon.
Geographical Review, Vol. 66, No. 1, p. 32-47, 1976. 5 fig., 2 tab., 12 ref. OWRT C-1629(3147)(9).

Descriptors: *Cities, *Waste water disposal, *Treatment facilities, *Networks, *Planning, Water supply, New York, New Jersey, Spatial distribution, Outlets, Model studies, Waste assimilative capacity, Self-purification, Optimization, Systems analysis.
Identifiers: *New York Metropolitan Region, Regional distribution, Regional planning.

If the New York-New Jersey Metropolitan Region water supply system is viewed as an environmental resource and if its two linked subsystems (water supply and water disposal) were part of a single system, many water quality problems could be avoided. Supply locations and disposal subsystems may have water resource diminishing impacts because of process interactions. Local shortages of organic waste assimilative capacity in surface waters as seen in degraded water quality, may be due to geographic maldistribution of effluent loadings and outfalls rather than water quality deficiencies. To evaluate waste disposal system performance, a water quality simulation model was developed to predict responses if effluents were modified in mass, time, and location; the model converted into an optimization model, would indicate choices among alternative management strategies; and the strategy implemented by inspecting waste load allocation impacts on receiving water quality. From a simulation model of the Raritan River's response to effluent loading, future impacts of disposal system design strategies on the river were evaluated under three predicted growth assumptions. It is concluded that a scarce resource was being managed wastefully; connections between the subsystems have a counterproductive relationship; inadequate links exist in the supply subsystem; and too many links are found in the disposal subsystem. (Buchanan-Davidson--Wisconsin)
W77-05985

ANALYSIS OF REGIONAL WASTE TREATMENT SYSTEMS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
D. W. Weeter, and J. G. Belardi.
Journal of the Environmental Engineering Division-ASCE, Vol. 102, No. EE1, p 233-237, February, 1976. 7 ref, append. OWRT A-035-PA(2).

Descriptors: *Waste water treatment, *Sewage treatment, *Sewerage, Analytical techniques, *Treatment facilities, Regional analysis, Regional economics, Alternative planning, *Optimization.
Identifiers: *Regional waste treatment facilities.

A technique had previously been developed to screen the large number of possible alternatives in the regional waste water treatment plant optimization problem. The problem involves a system of sources, each of which may be connected to any other source or treat its own sewage. The initial technique involves first determining the least-cost disposal alternative for the waste water at each source. If it is most economical for each of two systems to pipe waste water to the other, the deci-

sion with the least overall cost is determined. The amounts of waste water to be treated at each source are then determined. If these amounts have changed, the process begins again with determining the least-cost alternatives. This technique was unsuccessful for some systems of sources. Suggested improvements include checking for different disposal decisions rather than different amounts of waste water to be treated. The procedure for resolving contradictory decisions could also be simplified. The original technique will occasionally miss the optimal solution, but this problem could be corrected by checking 'the sources adjacent to those treating'. A mechanism should also be added to halt the procedure if a non-converging system is detected. The method of accumulating waste water flows was also revamped. The amount of manual calculation required could be reduced by determining the waste water accumulating at each source based on current disposal decisions as the first step. The ability to handle systems in which cycling is possible was also added to the original technique. Another modification makes it possible to handle systems in which not all sources are possible sites for treatment plants. (Snyder-FIRL)
W77-05987

COUPLED OPTIMIZATION-SIMULATION WATER QUALITY MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W77-05992

POLLUTION FEES ARE FOR REAL IN FRANCE,
Lyon Water and Power Co. (France).
For primary bibliographic entry see Field 5G.
W77-06046

PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06055

UREA AND AMMONIUM NITRATE; EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06056

CANNED AND PRESERVED SEAFOOD PROCESSING POINT SOURCE CATEGORY, EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06057

5E. Ultimate Disposal Of Wastes

FREEZER, VACUUM, OVEN SEWAGE TREATMENT SYSTEM,
Raymond Lee Organization, Inc., New York. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05653

TREATMENT OF WASTE ROLLING OIL,
Interlake, Inc., Chicago, Ill. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05663

PROTEIN COMPOSITION OF ACTIVATED SLUDGE FROM A KRAFT MILL EFFLUENT BIOLOGICAL TREATMENT PLANT (SKLAD BIALKA OSADU CZYNNEGO Z BIOLOGICZNEJ OCZYSZCZALNI SCIEKOW POSIARCZANOWYCH),
Instytut Technologii i Inzynierii Chemicznej ATR, Bydgoszcz (Poland).
Z. Kin, and C. Witkowski.
Przeglad Papierniczy, Vol 32, No 11, p 397-399, November, 1976. 9 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Activated sludge, *Proteins, Wastes, Industrial wastes, Water pollution sources, Sludge, Amino acids, Nitrogen compounds, Feeds, Foreign countries, Europe, *Biological treatment.
Identifiers: Poland.

The biological purification plant at the Swiecie kraft pulp and paper mill in Poland produces about 800 cu m of excess activated sludge daily, i.e., about 2.2 tons of protein. This activated sludge was analyzed to determine its feed value. The total protein content was determined by the Kjeldahl method, and the amino acid composition by chromatography. The data show that the amino acid composition of the sludge does not differ significantly from that of chicken egg white and fish meal. The digestibility of the sludge proteins was 58.7%. This composition warrants further studies to develop a suitable method for the removal of impurities so that the proteins could be used as animal feed. (Stapinski-IPC)
W77-05694

PURIFICATION OF WASTE WATERS FROM WET BARKING (RENING AV AVLOPPSVATTEN FRAN VATBARKNING),
IVL-Konsult A. B., Stockholm (Sweden).
For primary bibliographic entry see Field 5D.
W77-05698

SLUDGE DEWATERING AND HANDLING PRACTICES IN THE U.S. PAPER INDUSTRY,
National Council of the Paper Industry for Air and Stream Improvement, Inc., New York.
J. J. McKeown, and A. L. Caron.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Environmental Protection Service, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 170-194, March, 1976. 2 fig, 15 ref, 7 tab, 3 append.

Descriptors: *Pulp and paper industry, *Sludge treatment, *Dewatering, Wastes, Industrial wastes, *Waste treatment, Water pollution sources, Pulp wastes, Centrifugation, Waste storage, Filtration, Drying, Incineration, Screens, Sludge disposal, Recycling, Land forming, Burning, Environmental sanitation, Governments, Legislation, Water pollution control, Sludge, Solid wastes.
Identifiers: Vacuum, Pressing.

Practical experiences with the dewatering of various paper-mill sludges (by centrifugation, lagooning, vacuum filtration, pressing, drying, incineration, screening, etc.) are reviewed, based on a 1972 questionnaire survey, and disposal alternatives (recycling, land application, and combustion) are discussed in the light of environmental requirements and government regulations. (See also W77-05708) (Brown-IPC)
W77-05714

INCREASING THE BIOLOGICAL VALUE OF ACTIVATED SLUDGE (POVYSHENIE BIOLOGICHESKOI TSENNOSTI AKTIVNOGO ILA),
For primary bibliographic entry see Field 5D.
W77-05717

PHYSICAL, CHEMICAL, AND BIOLOGICAL ASPECTS OF SUBSURFACE ORGANIC WASTE INJECTION NEAR WILMINGTON, NORTH CAROLINA,
Geological Survey, Lakewood, Colo. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05739

GEOLOGIC EVALUATION OF WASTE-STORAGE POTENTIAL IN SELECTED SEGMENTS OF THE MESOZOIC AQUIFER SYSTEM BELOW THE ZONE OF FRESH WATER, ATLANTIC COASTAL PLAIN, NORTH CAROLINA THROUGH NEW JERSEY,
Geological Survey, Raleigh, N.C. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05753

ON RADIOACTIVE WASTE MANAGEMENT: MODEL ANALYSIS OF A PROPOSED SITE,
Alberta Univ., Edmonton. Dept. of Geology.
F. W. Schwartz.
Journal of Hydrology, Vol. 32, No. 3/4, p 257-277, February 1977. 10 fig, 4 tab, 7 ref.

Descriptors: *Radioactive wastes, *Radioactive waste disposal, *Groundwater, *Hydrogeology, *Canada, Climatology, Precipitation(Atmospheric), Groundwater movement, Seepage, Porosity, Porous media, Cation exchange, Chemical reactions, Model studies, Mathematical models, Geology, Hydrology.
Identifiers: *Waste disposal sites.

The proposed wastes management site at the Defence Research Establishment Suffieed appears suitable for storing solid low-level raioactive wastes with a half-life for radioactive decay less than 3,000 years. This conclusion was based on model trials which generally indicated that the subsurface environment will be effective in limiting the dispersal of radioactive contaminants in the groundwater system. Contaminant attenuation is produced by the physical process of dispersion, the chemical process of cation exchange, and the nuclear process of radioactive decay. A strong measure of contaminant confinement is provided by the relatively low seepage velocity within the porous medium. However, because of the uncertainties inherent in the definition of model parameters and because there is no historical record with which to calibrate the model, the results of the simulations must be treated in a very general way. Parameters in the model were derived from empirical relationships and a variety of field and laboratory studies which had been conducted over the past two years. Piezometric data indicated that the site is predominantly a recharge area. An unsaturated zone up to 36 m thick, a lack of water level fluctuations, and a semi-arid climate are evidence of the limited quantities of natural recharge to the groundwater system. Soil moisture data demonstrate that the most favorable sites for recharge are depressions within the area. (Sims-ISWS)
W77-05791

MANAGEMENT MODEL FOR WASTEWATER DISPOSAL ON LAND,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
A. Koenig, and D. P. Loucks.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE2, Proceedings paper No. 12870, April 1977. 3 fig, 1 tab, 17 ref.

Descriptors: *Waste water disposal, *Surface irrigation, *Land reclamation, *Infiltration, *Mathematical models, Drainage systems, Design criteria, Linear programming, Nitrogen, Water balance, Effluents, Storage, Lagoons, Ponds, Estimating, Biochemical oxygen demand, Planning, Constraints, Equations, Systems analysis.

Identifiers: Minimization, Soil-nitrogen balance, Soil-water balance, Wasteponds.

A model based on water and nitrogen balances in an effluent storage lagoon and in the soil at potential land application sites is developed and illustrated. The simple model, using linear programming, can assist in evaluating land disposal schemes for pretreated municipal waste water under different climatic conditions. A solution procedure is proposed that yields the minimum land area required for waste water disposal systems, given the drainae capacity of the soil and various constraints on the nitrate-nitrogen content of the drainage water. An example planning problem is solved which indicates the desirability of designing land disposal systems for maximum throughput of waste water effluent. Spedifically, results are obtained by first determining the soil-water balance finding the trade-off between the storage lagoon capacity and the nitrogen concentration in the lagoon effluent, and finalliy maximizing the nitrogen concentration in the irrigation waste water which can be applied to the land. It is concluded that if the concentration of nitrogen in the drainage effluent is a limiting constraint, then the best policy in designing a land disposal scheme is to provide good drainage for a maximum throughput of waste water effluent such that the nitrogen removal efficiency of the storage lagoon does not become limiting. (Bell-Cornell)
W77-05923

PROCEEDINGS OF THE CONFERENCE ON SALT AND SALINITY MANAGEMENT,
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 5G.
W77-05934

TIME-DEPENDENT DEVELOPMENT OF STRENGTH IN DREDGINGS,
Northwestern Univ., Evanston. Ill. Technological Inst.
For primary bibliographic entry see Field 5G.
W77-05966

A GEOGRAPHICAL SYSTEMS ANALYSIS OF THE WATER DISPOSAL NETWORKS OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York. Dept. of Geography.
For primary bibliographic entry see Field 5D.
W77-05985

TRACING SEWAGE EFFLUENT RECHARGE--TUCSON, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources; and Arizona Univ., Tucson. Coll. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W77-05999

5F. Water Treatment and Quality Alteration

APPARATUS FOR TREATING A LIQUID,
Vortex S/A. Luxemburg. (Assignee).
A. J. Wilkes.
U.S. Patent No. 3,986,957, 14 p, 13 fig, 1 tab, 9 ref; Official Gazette of the United States Patent Office, Vol 951, no 3, p 1156, October 19, 1976.

Descriptors: *Patents, *Water treatment, Water quality, *Water quality control, Oxygenation, Flow, Regulated flow, Flow control, Flow system, Flow characteristics, Gravity, Equipment.

This invention relates to an apparatus for treating a liquid whereby the quality and characteristics of the liquid can be improved or an aesthetic effect achieved. The apparatus allows the liquid to flow, under gravity, along the total flow path that is shaped and arranged to cause the liquid to carry out an oscillatory motion, a portion of flow being first diverted to one side and then the other of the mean flow direction, thereby establishing self-inducing and self-maintaining oscillations in specific rhythms that can be of varying periodicity and intensity. The apparatus includes a sloping floor surface and wall surfaces which together define the limits of a total flow path having a general downhill gradient in the mean direction of flow and a number of basins (recesses) placed at both sides of the mean direction of flow. The basins are arranged in pairs more or less axially symmetrically placed in relation to the mean flow path thus forming an element. (Sinha - OEIS)
W77-05666

CASE OF A POLLUTED WATER PIPELINE, (IN RUSSIAN),
For primary bibliographic entry see Field 5B.
W77-05687

BIOLOGICALLY MEDIATED WATER QUALITY DETERIORATION IN DISTRIBUTION SYSTEMS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
J. T. O'Connor, S. H. Lee, W. Knocke, and M. Collins.
Available from the National Technical Information Service, Springfield VA 22161 as PB-265 175, Price codes: A04 in paper copy, A01 in microfiche. Missouri Water Resources Research Center, Columbia, Completion Report, June 30, 1976. 52 p, 4 fig, 11 tab, 35 ref, 2 append. OWRT A-088-MO(1). 14-34-0001-6026.

Descriptors: Water quality, Corrosion, Microorganisms, *Missouri, *Distribution systems, Biodegradation, *Iron, *Dissolved oxygen, Pollutant identification, *Bacteria, Cities, Microbiology, *Chlorination, *Water treatment.

The study of water quality deterioration in distribution systems in Missouri has taken place in three phases. A specific study of water quality deterioration was made at Prairie Home, Missouri. Field surveys indicated a high iron concentration and depleted dissolved oxygen concentrations in the distribution system. High bacterial counts in distribution system were noted. Therefore, a continuous chlorination method was chosen to remedy the water quality problems. Both sulfate-reducing bacteria and iron-transforming bacteria were found even after the chlorination program. A survey questionnaire was sent to 250 Missouri water suppliers and rural water districts to determine the extent of water quality problems in distribution systems. Many water utilities experience water quality deterioration problems in their distribution systems. However, much of the data reported by the water utilities appears to be inappropriate for determining whether their problems are related to microbiological growth in distribution systems. Those utilities which experience water quality problems are currently combatting their problems with regular main flushing programs. Finally, a preliminary survey of water quality was initiated in a number of Missouri cities including Columbia, Moberly, Macon, Chillicothe, Marshall and Kansas City, Missouri. Preliminary microbiological findings are that water quality problems of those cities examined are associated with microbial growths in distribution systems.
W77-05928

SELECT MINERALS AND POTABLE REUSE OF RECLAIMED WASTEWATERS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
H. Wolf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 203, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 83, March 1977. 87 p, 51 ref, 7 append. OWRT B-146-TEX(4), 14-31-0001-3939.

Descriptors: *Reclaimed water, *Sodium, *Metals, *Sulfates, Calcium, Magnesium, Standards, *Human diseases, *Potable water, *Hardness(Water), Mineralogy, Water quality standards, *Public health, *Texas.
Identifiers: Dallas(Tex), *Minerals, College Station(Tex), Heart disease, Soft water, Hypertension, Cancer, *Urinary calculi, Kidney stones, Bladder stones.

The long-observed relationships of an influence of drinking water mineral content on heart-circulatory deaths are developed to indicate that sodium -- when present in sufficiently high concentrations -- may be detrimental to human health. An hypothesis is presented that suggests that drinking water sodium contributes more to the health effects picture than is ordinarily attributed to this normally minor avenue of ingestion by virtue of its influence on taste behavior. Mechanisms of action for metals as they relate to cancer and for sulfates as they relate to urinary calculi were also observed in the literature.
W77-05930

5G. Water Quality Control

AQUATIC ENVIRONMENTAL QUALITY: PROBLEMS AND PROPOSALS,
Fisheries and Marine Service, Ottawa (Ontario). Oceanography Branch.
For primary bibliographic entry see Field 6G.
W77-05636

RIVER TURBINE,
For primary bibliographic entry see Field 4A.
W77-05660

METHOD AND APPARATUS FOR CLARIFYING CONTAMINATED LIQUIDS,
George (A.L.), Inc., Lafayette, Ind. (Assignee).
For primary bibliographic entry see Field 5D.
W77-05664

APPARATUS FOR TREATING A LIQUID,
Vortex S/A. Luxemburg. (Assignee).
For primary bibliographic entry see Field 5F.
W77-05666

OIL SPILL APPARATUS,
H. E. Bagot, and S. P. Funkhouser.
U.S. Patent No. 3,986,959, 9 p, 8 fig, 9 ref; Official Gazette of the United States Patent Office, Vol 951, No 3, p 1156, October 1976.

Descriptors: *Patents, *Oil spills, *Oil pollution, *Water pollution control, Water quality control, Absorption, Flooding, Pollution abatement.
Identifiers: Sponges, Oleophilic material.

Various methods and apparatus have been developed for removing oil products floating on water. One type of these utilizes a sponge or mop which is basically oleophilic and hydrophobic. However, in other prior methods and apparatus there is one serious deficiency. The material must be brought up out of the water laden with oil and conveyed to a squeezing area. The avoid the difficulties associated with the prior art, the present invention starts out with a sponge which need not be picked out of the water. The sponge remains in the water floating on top absorbing the oil. To remove the oil which is absorbed, a buoyant squeezing apparatus is moved along the length of the sponge. Means are provided to pump or draw the oil to a suitable holding tank. The actual implementation of the invention may take many forms but the ability to pick up extremely large oil spills is of primary importantce. Large belts or sponges may be employed since it is not necessary to pick them up out of the water (Sinha - OEIS)
W77-05667

FLOATING DEVICE FOR REMOVING REFUSE SITUATED ON AND UNDER A WATER SURFACE,
J. Rafael.
U.S. Patent No. 3,988,241, 5 p, 2 fig, 11 ref; Official Gazette of the United States Patent Office, Vol 951, no 4, p 1609, October 26, 1976.

Descriptors: *Patents, *Water pollution treatment, Water quality control, *Water pollution control, Mixing, Flucculation, Floating, Sludge treatment, Equipment.

A floating device for removing refuse situated on and under a water surface is comprised of a water inlet feature, a mixing feature for mixing the polluted water with a flocculation agent, a resting or retention zone to calm the water and flocculate the refuse and a feature to remove the flocculated sludge from the water. The floating device is designed in such a way that it is divided into three parts. The polluted water is mixed with the flocculation agent in the first part, i.e. in a first floating body. The refuse is flocculated in the second part or in a resting zone designed as a hose-type duct. The flocculated sludge is removed from the water in the third part, i.e. in a second floating body. The hose-type duct can be foled up or rolled up and deposited on one of the two floating bodies when the task of cleaning the water has been completed. After the hose has been deposited on one of the two floating bodies, they can also be coupled together so that they form a single ship's body. (Sinha - OEIS)
W77-05668

BIOLOGICAL POSSIBILITIES FOR WASTE WATER PURIFICATION (CONSIDERATII ASUPRA POSIBILITATILOR BIOLOGICE DE PURIFICARE A APELOR REZIDUALE),
C. I. Simionescu, V. I. Popa, and V. Rusan.
Celuloza si Hirtie, Vol 25, No 2, p 76-78, April-June, 1976. 9 ref, 2 tab.

Descriptors: *Water pollution control, *Pulp and paper industry, Europe, Foreign countries, Waste water(Pollution), *Biomass, *Fermentation, Organic compounds, Inorganic compounds, Pollutants, Algae, Microorganisms, Effluents, Water pollution sources, Pulp wastes.
Identifiers: *Spent pulping liquors(Bioconversion), Romania.

Water pollution by pulp and paper mill effluents can be reduced essentially in two different ways, viz., increased utilization of lignocellulosic raw material so as to lower the volumes of discharged biomass, and utilization or conversion (fermentation) of effluent-contained organic and inorganic pollutants by algae and/or microorganisms. Some reported studies on bioconversions of spent pulping liquors are reviewed. (Brown-IPC)
W77-05685

PROCEEDINGS OF SEMINARS ON WATER POLLUTION ABATEMENT TECHNOLOGY IN THE PULP AND PAPER INDUSTRY.
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5D.
W77-05708

REGULATIONS AND WASTE CHARACTERIZATION,
Environmental Protection Service, Ottawa (Ontario).
J. L. Betts.
In: Proceedings of Seminars on Water Pollution Abatement Technology in the Pulp and Paper Industry, May 1975, Ottawa, Moncton, and Prince George, Canada, Water Pollution Control Directorate, Economic and Technical Review Report EPS 3-WP-76-4, p 1-14 plus two-page insert, March 1976. 3 fig, 5 ref, append.

Descriptors: *Canada, *Legislation, *Pollution abatement, Effluents, Biochemical oxygen demand, Chemical oxygen demand, Dissolved solids, Suspended solids, Color, Hydrogen ion concentration, Foaming, Flow measurement, Sampling, Water sampling, Pulp wastes, Sulfite liquors, Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources.
Identifiers: Technical nomenclature.

This discussion outlines Canadian government policy on pollution abatement; presents definitions of terms and abbreviations; and describes the purpose of effluent characterization (including effluent parameters, such as BOD, COD, dissolved and suspended solids, color, pH, foaming, etc), flow measurement, sampling techniques, and assessment of results for various types of effluents (kraft, bleached kraft, sulfite, nonsulfur, groundwood, newsprint, board, fine-paper, bag paper, and tissue mills). (See also W77-05708) (Brown-IPC)
W77-05709

SPILLWAYS WITH NOTCHED OVERFLOW EDGE (VODOSLIVY S ZUBCHATOI PERELIVNOI KROMKOI),
For primary bibliographic entry see Field 8B.
W77-05718

A STRUCTURAL-FUNCTIONAL ANALYSIS OF THE SOCIO-POLITICAL SYSTEM RELATIVE TO WATER AND RELATED LAND RESOURCES IN THE COASTAL ZONE OF SOUTH CAROLINA,
Clemson Univ., S. C. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W77-05722

A STUDY OF RUNOFF FROM SMALL RURAL WATERSHEDS IN RESPONSE TO COMPLETED AND PROPOSED LAND USE CHANGES,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05728

ON RADIOACTIVE WASTE MANAGEMENT: MODEL ANALYSIS OF A PROPOSED SITE,
Alberta Univ., Edmonton. Dept. of Geology.
For primary bibliographic entry see Field 5E.
W77-05791

LOCAL SCHEMES OF COMPLEX UTILIZATION AND PROTECTION OF WATER RESOURCES OF RIVER AND SEA BASINS IN THE NORTHERN CAUCASUS, (IN RUSSIAN),
Nauchno-Issledovatelskii Institut Epidemiologii, Mikrobiologii i Gigieny, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5B.
W77-05811

PHYSIOLOGICAL EFFECT OF TRIAZINE HERBICIDES ON TYPHA LATIFOLIA L.,
Polish Academy of Sciences, Mikolajki (Poland). Lab. of Chemical Ecology.
For primary bibliographic entry see Field 5C.
W77-05861

COMMENT ON 'AN OPTIMIZATION MODEL FOR REGIONAL WATER QUALITY MANAGEMENT' BY JOHN R. MCNAMARA,
California Univ., Los Angeles. Dept. of Engineering Systems.
C. R. Scherer.
Water Resources Research, Vol. 13, No. 1, p 221-222, February 1977. 8 ref.

Descriptors: *Water quality control, *Waste water treatment, *Treatment facilities, *River basins, Optimization, Management, Hydraulics, Methodology, Alternative planning, Decision making, Dissolved oxygen, Systems analysis, Mathematical models, Regional analysis, Hudson River.
Identifiers: Upper Hudson River, *Geometric programming, Cost minimization, Bypass piping, *Multiple options.

The author here comments on and criticizes aspects of McNamara's recent (1976) paper (see W76-08184) which considers the use of a geometric programming model for regional water quality management. The model is concerned with the minimization of investment and operating costs in waste water treatment plants subject to multiple dissolved oxygen constraints in a river basin. McNamara's contribution is the combination of multiple management options in one model. The application of geometric programming is a promising line of research since the method easily accommodates the multiplicative decision variables associated with unit treatment processes in series. However, although the intent of McNamara was to develop, and indeed he did develop, such a model capable of assessing a variety of pollution abatement techniques, as well as being compatible with an efficient solution procedure, he has not shown that this analytical technique can in fact be applied in this general case. The nature of the shortfall is outlined: The author criticizes McNamara's use in his illustrative examples of not more than two standard treatment options, and he questions McNamara's choice of the upper Hudson River as an application area, since the problem there requires only one option and this does not demonstrate the method as a tool for considering multiple water quality control options. Following this review article is McNamara's reply to Scherer, wherein he clarifies and defends his paper in question. (Bell-Cornell)
W77-05919

A TWO-DIMENSIONAL MATHEMATICAL MODEL FOR WATER QUALITY PLANNING IN ESTUARIES,
Mississippi State Univ., Mississippi State. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05926

ADVANCED METHODOLOGIES FOR DESIGN OF STORM SEWER SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-05927

SELECT MINERALS AND POTABLE REUSE OF RECLAIMED WASTEWATERS,
Texas A and M Univ., College Station. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W77-05930

PROCEEDINGS OF THE CONFERENCE ON SALT AND SALINITY MANAGEMENT,
California Univ., Davis. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 205, Price codes: A09 in paper copy, A01 in microfiche. Proceedings of the Conference held at Santa Barbara, California, Sept 23-24, 1976. Report 38, December 1976. 166 p.

Descriptors: *Salts, *Salinity, *Water management(Applied), *Water quality control, Irrigation, Waste water disposal, *Legislation, California, *Political aspects, *Institutions, Operations, Technology, Salt tolerance, Irrigation, Water utilization.
Identifiers: *Salt management (Western U.S.)

The conference concentrated on legislative and political aspects of salt and salinity management together with better understanding of new technology that affects operations and management. Not included is any consideration of desalting technology--which could occupy an entire conference by itself--nor any in-depth discussion of some of the theoretical and methodological modeling that is continually pushing back the frontier of knowledge. The conference concentrated on topics and an orientation that will be most immediately useful to those concerned with management and operation of water systems who must cope with the problems of salt and salinity management. (Snyder-California, Davis)
W77-05934

EFFECT OF SULFURIC ACID ON SODIUM-HAZARD OF IRRIGATION WATER,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W77-05942

TIME-DEPENDENT DEVELOPMENT OF STRENGTH IN DREDGINGS,
Northwestern Univ., Evanston. Ill. Technological Inst.
R. J. Krizek, and A. M. Salem.
Journal of the Geotechnical Engineering Division, American Society of Civil Engineers, Vol. 103, No. GT3, Proceedings Paper 12808, p 169-184, March 1977. 13 fig, 1 tab, 6 ref, 2 append. EPA 15070-GCK, R-800948.

Descriptors: *Dredging, *Spoil banks, *Landfills, *Soil strength, On-site investigations, Laboratory tests, Strength, Compressive strength, Shear strength, Channels, Channel improvement, Waste disposal, Soil mechanics.
Identifiers: *Compression tests, Unconfined compression, Time dependence, Secant modulus, Dredging wastes.

Environmental or economic considerations, or both, often dictate that maintenance dredgings be placed within diked containment areas to form landfills of limited quality. Documented in this investigation was a 4-yr history of the development of shear strength with time a four typical landfill disposal sites near Toledo, Ohio. When synthesized in accordance with the different deposition histories of the sites and the basic assumption that the materials in each of the four sites are essentially similar, a reasonably meaningful history of shear strength development at a hypothetical dredging disposal site over a period of about a decade can be deduced. Methods of shear strength determination include field vane, laboratory vane, fall cone, and unconfined compression tests. The laboratory tests were conducted on continuous samples obtained by means of a specially developed manually operated piston sampler, and comparisons were made with the results of the field tests. (Sims-ISWS)
W77-05966

TRANSIENT HEAT RELEASES FROM OFFSHORE NUCLEAR PLANTS,
Massachusetts Inst. of Tech. Cambridge. Energy Lab.
For primary bibliographic entry see Field 5B.
W77-05967

TRACER MEASUREMENT OF REAERATION: III. PREDICTING THE REAERATION CAPACITY OF INLAND STREAMS,
Tsivoglou (E. C.) Inc., Atlanta, Ga.
E. C. Tsivoglou, and L. A. Neal.
Journal of the Water Pollution Control Federation, Vol. 48, No. 12, p 2669-2689, December 1976. 13 fig, 2 tab, 15 ref.

Descriptors: *Reaeration, *Tracers, *Water quality, *Marking techniques, *Aeration, Waste treatment, Analytical techniques, Turbulence, Topography, Flow, Hydraulics, Model studies, Oxygenation, Fluorescent dye, Tracking techniques, Streams, Diffusion, Dispersion, Dissolved oxygen, *Forecasting.
Identifiers: *Reaeration capacity, *Tracer measurements, *Tracer techniques, Pollution control, *Stream purification, Inland streams, Radiotracer measurements, Energy dissipation model, Hydraulic features, Stream reaeration.

Field radiotracer measurements of the reaeration rate coefficient, K sub 2, in 24 different streams were summarized and used to develop an energy dissipation model for predicting reaeration in nontidal free-flowing streams. The field studies included a wide range of hydraulic properties and stream flows. The energy dissipation model is K sub 2=C (delta h/t su f) , where K sub 2 is the reaeration rate coefficient (natural base); delta h is the water surface elevation change through a stream segment; t sub f is the time of flow; and C is the escape coefficient. In a total of 605 individual field tracer measurements of K sub 2 and the associated hydraulic properties, the observed coefficients ranged from essentially zero to as much as 15.0/hr at waterfalls. For predictive purposes, recommended values were provided for the escape coefficient, C. In addition, a generagl stream slope model was presented, although it is not as reliable as the energy dissipation model. (See also W69-02821) (Henley-ISWS)
W77-05977

MEASUREMENT OF ENVIRONMENTAL TRADE-OFFS AND PUBLIC POLICY: A CASE STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W77-06002

THE EFFECT OF COAL SURFACE MINING ON THE WATER QUALITY OF MOUNTAIN DRAINAGE BASIN STREAMS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-06012

CONNECTICUT RIVER WATER RESOURCE DECISION-MAKING,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 6B.
W77-06017

MURKY WATERS: PRIVATE CLAIMS TO DEEP OCEAN SEABED MINERALS,
For primary bibliographic entry see Field 6E.
W77-06043

GROUND WATER PROBLEMS WITH OIL SHALE MINING IN THE PICEANCE BASIN,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-06045

POLLUTION FEES ARE FOR REAL IN FRANCE,
Lyon Water and Power Co. (France).
F. Fiessinger, and P. F. Teniere-Buchot.
Water Spectrum, Vol 8, No 1, p 29-35 (Spring-Summer 1976). 2 fig, 3 photo, 1 drawing.

Descriptors: *Water pollution control, *Foreign countries, *Pollution taxes(Charges), *Water quality control, Basins, Hydrography, Population, Legislation, Financing, Suspended solids, Toxicity, Effluents, Treatment, Water management(Applied), Water policy, Water resources, Water costs, Water users, Waste water treatment.
Identifiers: *Pollution fees, *France, Basin committee, Basin agency, Basin commission.

The year 1964 marked a turning point in the management of France's water quality problems. A new law was passed which required the settling of water related problems through a consensus of all users within each of six hypographic basins covering the entire country. Two types of organizations were set up to implement the new law. The first type is the basin committee. The second type is the basin agency which executes the committee decisions. The basic objective of the agencies are: developing water resources and fighting pollution. Communities are provided with subsidies ranging from 20 to 40 percent of investment cost to build sanitation works. The means to support these subsidy programs came from a carefully calculated system of withdrawal and pollution fees. The amounts collected are determined by two opposing factors: the cost of greater purification, and the willingness of the general public to support the improvement. Some of the fee measurement criteria are: (1) amounts of suspended solids; (2) amounts of soluble salts; (3) toxicity of the effluent. Quality objectives and long term goals are also taken into account in the application of fees. (Martin-Florida)
W77-06046

CALIFORNIA--'SAVING THE COAST',
For primary bibliographic entry see Field 6G.
W77-06048

ACHIEVEMENTS IN MARINE CONSERVATION, 1. MARINE PARKS,
International Union for Conservation of Nature and Natural Resources, Morges (Switzerland). Commission on Ecology.
M. Bjorklund.
Environmental Conservation, Vol 1, No 3, p 205-17, Autumn 1974. 1 map, 35 ref.

Descriptors: *Oceans, *Natural resources, *Pollution, *Protection, Dredging, Mining, Oil, Exploitation, Exploration, Gravels, Law of the sea, International law, Jurisdiction, Parks, Governments, Ecology, Thermal pollution, Effluents, Pollutants, Conservation, Marine biology, Beds, Coasts.
Identifiers: *Marine preserves, Marine ecosystems, Deep sea mining, Ocean dumping.

Exploitation of the natural resources of the ocean beds and coastal zones has increased to the point that serious environmental problems have emerged. Activities such as off-shore dredging for sand and gravel, oil and gas exploitation, and mineral extraction should be controlled through an international program for the allocation and conservation of marine resources since the open seas have historically been considered as belonging to all countries. A number of countries have established marine parks and reserves in order to protect a portion of the marine ecosystem. The author provides a brief review of the status of marine conservation in various regions around the world including North America, South America, Antarctica, the Indo-Pacific, the Caribbean, Africa, the Mediterranean, and Northern Europe. Since concentrated use and development has had a detrimental effect on many coastal zones and estuaries, the author suggests that a high priority international program for marine conservation be established. (Capehart-Florida)
W77-06049

LEGAL ASPECTS OF WATER POLLUTION CONTROL,
Imperial Government of Iran, Tehran.
M. Sarmad.

In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas Venezuela; Published by The Commission for the National Water Resources Development Plan (Coplanarh), Caracas, Venezuela, p 1075-1085, 1976.

Descriptors: *Foreign countries, *Water pollution control, *Legislation, *Law enforcement, *Penalties(Legal), *Pollution taxes(Charges), Governments, Social aspects, Legal aspects, Economic impact, Standards, Water quality standards, Regulation, Abatement, Water pollution, Water pollution treatment, Planning, Administrative agencies, Permits, Effluents.
Identifiers: Licenses, Effluent limitations, Administrative regulations, Iran.

The solution to water pollution is a multidisciplinary task. Such fields as civil engineering, chemistry, biology and law are needed in order to develop a complete answer. The role of law in pollution abatement is two-fold. Primarily, it must produce effective practical legislation to achieve desired ends. Secondly, efficient enforcement procedures must be developed to ensure that the standards are met. Effective legislation will first consider the present condition of the water and then work backwards in increments to achieve the level of water quality desired. Sudden stringent requirements would have a severe economic impact on society. Governments must also supply adequate budgetary resources to accomplish the legislative goals. These monies can be obtained by taxing a polluter commensurate with the amount of pollution he emits. Sanctions are necessary in order to enforce the pollution laws. Appropriate sanctions would include extremely high pollution taxes, civil penalities, injunctions, and criminal penalties for flagrant violations. Adequate enforcement is also necessary. An anti-pollution police force could determine whether water quality standards are being met, and utilize the judicial remedies provided by the legislature. (Moorhouse-Florida).
W77-06050

ENVIRONMENTAL LAW--COMMERCE CLAUSE--CONGRESS MAY PROHIBIT THE DISCHARGE OF OIL INTO NONNAVIGABLE TRIBUTARY OF NAVIGABLE WATER ABSENT SHOWING THAT OIL REACHED AND POLLUTED NAVIGABLE WATER,
G. E. Ashworth, Jr.
Alabama Law Review, Vol 27, p 227-248, Spring 1975.

Descriptors: *Constitutional law, *Federal Water Pollution Control Act, *Navigable rivers, *Tributaries, *Non-navigable waters, Legislation, Federal jurisdiction, Judicial decisions, Law enforcement, Legal review, Path of pollutants, Water law, Oil pollution, Legal aspects, Water pollution sources, Water pollution control.
Identifiers: *FWPCA Amendments of 1972, Navigability tests, Navigation obstructions.

In United States v. Ashland Oil and Transport Co., the Sixth Circuit Court of Appeals held that Congress has the power to control pollution in nonnavigable tributaries of navigable waters and no proof need be offered that pollution actually reaches navigable waters. The Federal Water Pollution Control Act, as amended, was thus found to be a legitimate constitutional exercise of Congressional commerce power. The puzzling aspect of the decisions was its basis in navigability since no proof of navigability impairment was required. The opinion suggests that a narrow concern with 'navigable waters' is not the extent of Congressional power. The district court had adopted the broader view that pollution may be regulated simply because of its effect on navigable waters. The Sixth Circuit rejected this view, ostensibly. Yet the lack of any proof of navigability impairment and the general language of the opinion suggest agreement with the lower court. (Comer-Florida)
W77-06053

POST CARACAS: STRIKING A BARGAIN FOR SETTLEMENT AT GENEVA,
Columbia Univ., New York. School of Law.
For primary bibliographic entry see Field 6E.
W77-06054

PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D.C.
Federal Register, Vol. 41, No. 34, p. 7685-7700, February 19, 1976.

Descriptors: *Pulp and paper industry, *Pulp wastes, *Federal government, *Administrative agencies, Federal Water Pollution Control Act, Regulation, Effluents, Water treatment, Permits, Waste water treatment, Wastes, Wood wastes, Water pollution sources, Organic wastes, Lumbering.
Identifiers: *Effluent limitations, *Effluent guidelines, Federal Water Pollution Control Act Amendments of 1972(FWPCA).

Pursuant to provisions and amendments of the Federal Water Pollution Control Act (FWPAC), the Environmental Protection Agency (EPA) proposed guidelines and standards limiting discharge of effluents from pulp operations. Standards are outlined for existing and new point sources, and for pretreatment standards for discharge into sewer systems. All of the standards are based on effluent reductions attainable through the application of the best practicable control technology currently available. The standards are put into sixteen categories depending on the type of pulp processing; included are various kraft categories, groundwoods, sulfite, soda, deink, and NI divisions. Specific figures are provided for effluent limitation on a daily maximum and 30-day average basis, for BOD5, TSS, Color, and pH. Provisions are indicated for public participation in the rulemaking by the submission of written comments on any aspect of the proposed regulations, and copies of supporting materials will be made available for inspection at the EPA library in Washington, D.C. The Federal Water Pollution Control Act requires the achievement of the effluent limitations not later than July 1, 1977. (Molloy-Florida)
W77-06055

UREA AND AMMONIUM NITRATE; EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
Federal Register, Vol 41, No 138, p 29429-32, July 16, 1976. 16 tab.

Descriptors: *Fertilizers, *Standards, *Waste water treatment, *Industrial wastes, Administrative agencies, *Ureas, *Ammonium compounds, Economic impact, Runoff, Federal government, Ammonia, Nitrogen, Waste treatment, Chemical industry, Nitrogen compounds, Agricultural chemicals, *Nitrates, Agricultural runoff, Water quality control.
Identifiers: *Administrative regulations, Ammonium nitrate.

The Environmental Protection Agency has proposed amending the effluent guidelines and standards for the urea and ammonium nitrate subcategories of the fertilizer manufacturing point source category. The procedure used to determine the new guidelines is outlined. An appendix is included which summarizes the information used as a basis for the proposed regulation. The effluent characteristics for which limitations are established are ammonia, organic nitrogen, and pH. Guidelines are proposed for the reduction attainable by application of the best practicable control technology currently available and for the reduction attainable by application of the best available technology economically achievable. Standards of performance are set for new sources. Discharges from shipping losses and precipitation runoff are excluded from these regulations. (Capehart-Florida)
W77-06056

CANNED AND PRESERVED SEAFOOD PROCESSING POINT SOURCE CATEGORY, EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
Federal Register, Vol 40, No 231, p 55770-801, December 1, 1975.

Descriptors: *Fish handling facilities, *Fish, *Canneries, *Waste water treatment, *Regulation, Effluents, Industrial wastes, Shellfish, Biochemical oxygen demand, Chemical oxygen demand, Standards, Bottom fish, Catfishes, Salmon, Crabs, Oysters, Shrimp, Water quality, Water quality control, Administrative agencies, Federal government, Pollution.
Identifiers: *Administrative regulations.

The Environmental Protection Agency is establishing final effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources in the canned and preserved seafood processing category. The processing subcategories included in the regulation are catfish, tuna, bottom fish, crab, shrimp, salmon, clam, oyster, sardine, scallop, herring, and abalone. The effluent characteristics for which limitations are set are BOD5, TSS, oil and grease, and pH. Comments on the regulation were solicited from members of the seafood processing industry. These comments and the response to them by the Environmental Protection Agency are summarized in the notice of the regulation. (Capehart-Florida)
W77-06057

UNITED STATES V NORFOLK DREDGING COMPANY ($3,000 PENALTY FOR MINOR OIL SPILL NOT EXCESSIVE).
For primary bibliographic entry see Field 6E.
W77-06058

TRI-COUNTY LANDFILL COMPANY V ILLINOIS POLLUTION CONTROL BOARD (LANDFILLS POLLUTING WATERS TERMED HAZARDS).
For primary bibliographic entry see Field 6E.
W77-06066

MONSANTO COMPANY V ILLINOIS POLLUTION CONTROL BOARD (REQUIREMENTS FOR PETITIONING FOR PERMANENT VARIANCE FROM WATER POLLUTION REGULATIONS PERTAINING TO MERCURY DISCHARGE INTO PUBLIC SEWER SYSTEM).
For primary bibliographic entry see Field 6E.
W77-06068

PROCEEDINGS MISSISSIPPI WATER RESOURCES CONFERENCE 1976.
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W77-06084

BAY SPRINGS LAKE WATER QUALITY STUDY,
Army Engineer Waterways Experiment Station, Bicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-06087

CONTROL OF WATER POLLUTION FROM CROPLAND, VOLUME 1--A MANUAL FOR GUIDELINE DEVELOPMENT,
Agricultural Research Service, Washington, D.C.
B. A. Stewart, D. A. Woolhiser, W. H. Wischmeier, J. H. Caro, and M. H. Frere.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-249 517, Price codes: A06 in paper copy, A01 in microfiche. Prepared as a joint publication of Office of Research and Development, EPA, and Agricultural Research Service, USDA. Report EPA-600/2-75-026a, July 1975. 40 fig, 21 tab.

Descriptors: *Return flow, Sediments, Nutrients, *Pesticides, Crop production, Agriculture, Pollution, Water quality, Water pollution control, *Sediment control, *Nutrient removal.

Engineering and agronomic techniques to control sediment, nutrient, and pesticide losses from cropland were identified, described, and evaluated. Methodology was developed to enable a user to identify the potential sources of pollutants, select a list of appropriate demonstrated controls, and perform economic analyses for final selection of controls. The information is presented in the form of regional maps, decision flow charts, tables, and brief technical highlights. (Skogerboe-Colo St)
W77-06097

SCIENTIFIC IRRIGATION SCHEDULING FOR SALINITY CONTROL OF IRRIGATION RETURN FLOWS,
Agricultural Research Service, Kimberly, Idaho. Snake River Conservation Research Center.
M. E. Jensen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-249 114, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Technology Series, Report EPA-600/2-75-064, November 1975. 91 p, 5 fig, 4 tab, 97 ref, append.

Descriptors: Irrigation, *Irrigation efficiency, *Return flow, Irrigated land, *Leaching, Salinity, Management, *Scheduling, Reviews, Water pollution control, Irrigation water.
Identifiers: *Irrigation scheduling, Leaching fraction, *Salinity control.

A comprehensive review is presented of irrrigation water management principles, factors to be considered in improving irrigation water management, leaching requirements, climatological approaches to irrigation scheduling, scope of irrigation scheduling in 1974, basic concepts of scheduling services, and probable effects of scientific irrigation scheduling on salinity of return flows. A definition of irrigation water management efficiency is presented to evaluate the annual volume of irrigation water used relative to the optimum amount needed for maximum annual crop production or income. The term considers the minimum, but essential water needed for both consumptive and nonconsumptive uses. The lack of significant change in irrigation efficiency during the past several decades is discussed and attributed to problems associated with the management of a complex soil-crop-environment system, a lack of economic incentives to make improvements, and ineffective traditional approaches to improve irrigation scheduling. New proposed minimal leaching practices are discussed. (Skogerboe-Colo St)
W77-06098

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

INTRODUCTION AND OVERVIEW,
National Bureau of Economic Research , Inc. Washington, D.C.
For primary bibliographic entry see Field 6B.
W77-05669

FLOOD PLAIN MANAGEMENT THROUGH ALLOCATION OF LAND USES -- A DYNAMIC PROGRAMMING MODEL,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6F.
W77-05720

COMMENT ON 'AN OPTIMIZATION MODEL FOR REGIONAL WATER QUALITY MANAGEMENT' BY JOHN R. MCNAMARA,
California Univ., Los Angeles. Dept. of Engineering Systems.
For primary bibliographic entry see Field 5G.
W77-05919

DISCRETE REPRESENTATION OF STORAGE FOR STOCHASTIC RESERVOIR OPTIMIZATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.; and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 4A.
W77-05921

MODELS FOR CAPACITY PLANNING OF WATER SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
D. T. Lauria, D. L. Schlenger, and R. W. Wentworth.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. EE2, p 273-291, Proceedings paper No. 12880, April 1977. 7 fig, 3 tab, 14 ref, 3 append.

Descriptors: *Approximation method, *Water supply, *Standards, *Optimization, *Investment, Costs, Model studies, Economies of scale, Sanitary engineering, Design, Planning, Systems analysis, Construction, Equations.
Identifiers: *Capacity planning, Waiting period, Social costs, Penalty costs, Cost minimization, Capacity expansions.

Several mathematical models are reported in the technical literature for finding the optimal capacity of water systems. Many require the use of numerical techniques and of the computer for solution. Simple approximating equations are presented for calculating the optimal design periods of two models particularly relevant to sanitary engineering; one pertains to capacity expansions and the other to initial construction where facilities have not yet been built. The objective function is cost minimization. The principal contribution of this paer is a model for determining the optimum waiting period prior to constructing new systems; an approximating equation is presented for the optimality conditions to avoid use of numerical methods. Model assumpltions are apropriate for both economicall advanced and developing countries. The penalty cost of not satisfying demands is shown to be a key model parameter; a method is presented for inputting its value. Numerical examples are included. Many of the assumptions of the models herein are identical. Among the more obvious assumptions are linearly increasing demand and instantaneous project implementation. It is also assumed that facilities are unable to produce beyond maximum capacity, that target demands are fixed, that cost functions for both initial construction and expansions are identical and constant over time, and that the planning horizon is infinite. (Bell-Cornell)
W77-05924

GOAL PROGRAMMING MODEL FOR WATER QUALITY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W77-05925

AN HIERARCHICAL GOAL PROGRAMMING APPROACH TO ENVIRONMENTAL-LAND USE MANAGEMENT,
Texas Univ. at Austin.
For primary bibliographic entry see Field 6G.
W77-05979

A GEOGRAPHICAL SYSTEMS ANALYSIS OF THE WATER DISPOSAL NETWORKS OF THE NEW YORK METROPOLITAN REGION,
Columbia Univ., New York. Dept. of Geography.
For primary bibliographic entry see Field 5D.
W77-05985

ANALYSIS OF REGIONAL WASTE TREATMENT SYSTEMS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-05987

MULTIOBJECTIVE PROGRAMING IN WATERSHED MANAGEMENT: A STUDY OF THE CHARLESTON WATERSHED,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 4D.
W77-05994

EXTENDED PERIOD SIMULATION OF WATER SYSTEMS--PART B,
Systems Control, Inc., Palo Alto, Calif.
For primary bibliographic entry see Field 4A.
W77-05996

PREDICTIVE WATER DEMAND MODEL FOR CENTRAL AND SOUTHERN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach. Resources Planning Dept.
For primary bibliographic entry see Field 6D.
W77-06047

6B. Evaluation Process

INTRODUCTION AND OVERVIEW,
National Bureau of Economic Research , Inc. Washington, D.C.
H. M. Peskin, and E. P. Seskin.
In: Cost-Benefit Analysis and Water Pollution Policy. The Urban Institute, Washington, D.C. 1975, p 1-33. 20 ref. (Paper submitted to EPA symposium, Annapolis, Maryland, Sept. 1973).

Descriptors: *Cost-benefit analysis, *Economic efficiency, *Costs, *Benefits, *Water pollution control, Water policy, Assessment, Projects, Effects, Estimating, Pollutants, Engineering, Discount rates, Land, Demand, Systems analysis, Risks.
Identifiers: Tangible effects, Intangible effects, Transfer function, Decision theory.

The basic concepts used in cost-benefit analysis are the center of much confusion, expecially among many policy makers. Examined herein are the concepts of efficiency, benefit, and cost. Cost-benefit analysis is a formal procedure for comparing the cost and benefits of alternative policies. The methodology's primary goal is to achieve allocative efficiency; project benefits are defined by how much people are willing to pay for project outputs. Next, the most important issues associated with the assessments of benefits are clarified and contrasted: (1) allocative vs. distributional effects; (2) primary vs. secondary effects; (3) tangible vs. intangible effects; and (4) partial vs. general analysis. In considering the implementation of benefit assessments, the kinds of information needed by the analyst are discussed; conditions under which a variety of approaches to benefit assessment might be used are clarified. The two main issues in the assessment of costs are examined: (1) partial analysis vs. a systems approach; and (2) estimating costs on a short-run vs. a long-run basis. Next, major problems faced in estimating the costs of reducing water pollution are highlighted; suggested approaches to cost estimation are given. Aspects of an uncertain future can be analyzed by considering social discount rate, option value and irreversibility, and the role of decision theory. Finally, important institutional factors in cost-benefit analysis are discussed; considered are institutional structures, and the question of whether cost-benefit analysis should be conducted by the sponsoring agency or by outside analysts is raised. The relation between cost-benefit analysis and policy evaluation is discussed in conclusion. (See also W76-11153) (Bell-Cornell)
W77-05669

WATER RESOURCES ISSUES FOR A GROWING COAL INDUSTRY,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
For primary bibliographic entry see Field 6D.
W77-05675

A STRUCTURAL-FUNCTIONAL ANALYSIS OF THE SOCIO-POLITICAL SYSTEM RELATIVE TO WATER AND RELATED LAND RESOURCES IN THE COASTAL ZONE OF SOUTH CAROLINA,
Clemson Univ., S. C. Dept. of Political Science.
H. E. Albert, and M. R. Pilo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 884, Price codes: A12 in paper copy, A01 in microfiche. South Carolina Water Resources Research Institute, Clemson, WRRI Report No. 67, January 1977. 246 p, 1 fig. B-061-SC(1).

Descriptors: *Planning, *Economics, *Local governments, Competing uses, *Computer programs, *South Carolina, Coastal plains, Political aspects, Social aspects, Organizations, Pollution abatement, Decision making.
Identifiers: Myrtle Beach(SC), Georgetown(SC), Charleston(SC), Beaufort Horry County, Georgetown County, Charleston County, Berkeley County, Colleton County, Beaufort County, Jasper County.

A structural-functional analysis was made of the socio-political system of the seven coastal counties of South Carolina (Horry, Georgetown, Berkeley, Charleston, Colleton, Beaufort, and Jasper) for the purpose of developing an additional input system for those decision-makers concerned with water and related land resources planning for the coastal zone. Active and latent political interest groups were identified, as well as the governmental units with jurisdiction over parts of the coastal zone, and interviews were conducted with them. A unity index was developed for the various governmental units and a power index for the interest groups. All data were stored in the computer and in combination with the indexes should be useful to planners for the coastal zone--useful in siting industry where it will be most welcome and in calculating the degree and nature of opposition to be expected for any given type of industry in any given location.
W77-05722

EVALUATION OF AGRICULTURAL ADJUSTMENT TO IRRIGATION WATER SALINITY: A CASE STUDY FOR PINAL COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 3C.
W77-05733

ENVIRONMENTAL IMPACTS OF LAND USE CHANGE,
Hawaii State Dept. of Planning and Economic Development, Honolulu. Research and Economic Analysis Div.
For primary bibliographic entry see Field 6G.
W77-05922

MODELS FOR CAPACITY PLANNING OF WATER SYSTEMS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 6A.
W77-05924

GOAL PROGRAMMING MODEL FOR WATER QUALITY PLANNING,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5D.
W77-05925

ASSESSING PROGRAM IMPACT--WATER RESOURCES PLANNING ACT, TITLE III,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6E.
W77-05989

MULTIOBJECTIVE PROGRAMING IN WATERSHED MANAGEMENT: A STUDY OF THE CHARLESTON WATERSHED,
Arizona Univ., Tucson. Dept. of Systems and Industrial Engineering.
For primary bibliographic entry see Field 4D.
W77-05994

MEASUREMENT OF ENVIRONMENTAL TRADE-OFFS AND PUBLIC POLICY: A CASE STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W77-06002

CONNECTICUT RIVER WATER RESOURCE DECISION-MAKING,
Massachusetts Univ., Amherst. Water Resources Research Center.
E. R. Kaynor.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 390, Price codes: A18 in paper copy, A01 in microfiche. Completion Report FY-77-6, Publication No. 83, July 1976. 386 p, 2 fig, 26 tab, 303 ref, 8 append. OWRT C-4116(No. 9058)(1).

Descriptors: *Interstate rivers, *Connecticut River, *Decision-making, *Management, Water supply, Water resources, Hydroelectric power, Flood control, Water pollution control, Recreation, Water conservation, History, Diversion, Planning, *Project planning.

Development of resource projects and programs in the Connecticut River basin are traced from Colonial times to the present. Case materials on five areas of modern concern are emphasized. They are water supply (including out-of-basin diversion), water pollution control, flood control, electric power generation, and recreational/preservational programs. Methods employed include historical reconstruction through written documents, interview of participants in current resource planning programs, participant observation, and an experimental attempt to simulate a decision-making situation. Theoretical focus is on how decisions to undertake basin resource programs evolved and on what bearing prior resource actions have on decisional options. A major conclusion is that incremental planning strategies have produced more satisfactory outcomes than comprehensive planning strategies, but that planning theory suffers from its conceptual disassociation of rational-deductive methodology and incremental strategy. (Leffert-Massachusetts)
W77-06017

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

ENVIRONMENTAL PROTECTION COSTS IN THE SWEDISH PULP AND PAPER INDUSTRY (MILJOVARDSKOSTNADER I SVENSK MASSA-OCH PAPPERSINDUSTRI),
For primary bibliographic entry see Field 5D.
W77-05701

ENVIRONMENTAL IMPACTS OF LAND USE CHANGE,
Hawaii State Dept. of Planning and Economic Development, Honolulu. Research and Economic Analysis Div.
For primary bibliographic entry see Field 6G.
W77-05922

CONSERVATIONAL WATER PRICING FOR INCREASED WATER SUPPLY BENEFITS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6D.
W77-05993

IMPLICATIONS OF RISING ENERGY COSTS FOR IRRIGATED FARMS IN THE OKLAHOMA PANHANDLE,
Oklahoma State Univ., Stillwater. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 3F.
W77-05995

6D. Water Demand

WATER RESOURCES ISSUES FOR A GROWING COAL INDUSTRY,
Illinois Univ. at Urbana-Champaign. Water Resources Center.
G. E. Stout, and E. D. Brill.
Presented at Conference on 'Water for Energy Development,' Engineering Foundation and U.S. Water Resources Council, December 5-10, 1976. 25 p, 10 ref., 5 tab., 1 fig. OWRT B-092-ILL(2).

Descriptors: *Energy, *Water requirements, *Natural resources, *Planning, *Fossil fuels, Water resources, *Ohio River, *Water demand.
Identifiers: *Coal resources development.

Developing the abundant domestic coal resources represents one way of meeting future energy needs. Since coal is a dirty fuel, as compared to oil and gas, direct combustion leads to unacceptable environmental degradation. As a result, much attention is being given to converting coal to other

solid, liquid, and gaseous forms before use. Large amounts of water are 'consumed' in some of these conversion processes; and, in addition, large amounts of water may be used for cooling purposes. The amount of intake water required and the amount lost to evaporation depend greatly on the cooling technology employed. Although water is generally abundant in the eastern part of the United States, there are already local shortages. Also, proper planning of water development must recognize competing municipal, industrial, and agricultural uses as well as instream uses, such as navigation. Thus, social, political, and legal issues, as well as technical ones, must be considered as management programs are designed. The issues are discussed for the Ohio River Valley area.
W77-05675

WATER RESOURCES OF WASHTENAW COUNTY, MICHIGAN,
Geological Survey, Lansing, Mich. Water Resources Div.
F. R. Twenter, R. L. Knutilla, and J. O. Nowlin.
Washtenaw County Metropolitan Planning Commission, Ann Arbor, Michigan, 1976. 143 p, 43 fig, 18 tab, 25 ref.

Descriptors: *Water resources, *Groundwater resources, *River basins, *Water quality, *Water demand, Available water, *Wisconsin, Human population, Projections, Water utilization, Urbanization, Streamflow, Flow rates, Aquifer characteristics, Water yield, Water analysis, Chemical analysis.
Identifiers: Washtenaw County(Mich).

By the year 2000 about 400,000 people will be living in Washtenaw County, Mich. Most will live in the Ann Arbor-Ypsilanti area. About 68 million gallons of water per day will be needed. Washtenaw County is drained by streams in the Grand, Rouge, Huron, Raisin, and Stony River basins. During an average year, more than 700 cfs (cubic feet per second) of water is discharged discharged from the county by streams in these basins. The Huron River, the largest stream, has an average annual discharge of 439 cfs at Ann Arbor. Most surface water in Washtenaw County has less than 500 mg/liter dissolved solids and is generally of a calcium bicarbonate type. Glacial deposits and bedrock are tapped for water supplies. Glacial deposits yield water throughout the county. In places, yeilds may be only enough for domestic supply. Elsewhere, permeable deposits may yield 3,000 gallons per minute for several wells in one well field. Bedrock yields water to wells primarily along the west margin and in the southeast corner of the county. Most bedrock will not yield sufficient water for large industrial or public supplies. Water from glacial deposits is generally of good quality, has low to moderate dissolved-solids content, and is of the calcium bicarbonate type. Water from bedrock is of varible quality, and dissolved solids increase with depth. In water from bedrock, sodium plus potassium constitute more than 60 percent of the cations. (Woodard-USGS)
W77-05759

USE OF WATER IN ARKANSAS, 1975,
Geological Survey, Little Rock, Ark. Water Resources Div.
H. N. Halberg.
Arkansas Geological Commission, Little Rock, Water Resources Summary No 9, 1977. 28 p, 3 fig, 7 tab, 56 ref.

Descriptors: *Water utilization, *Groundwater, *Surface waters, *Arkansas, Aquifers, Withdrawal, Reservoirs, Comsumptive use, Irrigation, Electric power production, Fish farming, Municipal water, Domestic water, Industrial water, Thermal powerplants, Water supply, *Water demand.

Arkansas used an average of 5,064 mgd (million gallons of water per day) in 1975, 65 percent more than in 1970. This total does not include 52,400 mgd used in the generation of hydro-electric energy. About half the total, or 2,440 mgd was used for irrigation, most of which 86 percent, was ground water. Generation of thermo-electric energy, using fossil and nuclear fuels, required 1,717 mgd or one-third of the State's water use. Fish and minnow farming used 342 mgd, 7 percent of the total. Forty three percent of the total, 2,203 mgd was consumed. A little more than half the water used was ground water; streams and reservoirs supplied the rest. The public-supply systems furnished 207 mgd, 41 mgd more than in 1970; industry supplied itself with 196 mgd, which was 13 mgd less than in 1970. (Woodard-USGS)
W77-05761

CONSERVATIONAL WATER PRICING FOR INCREASED WATER SUPPLY BENEFITS,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
D. I. Carey, and C. T. Haan.
Water Resources Bulletin, Vol. 12, No. 6, p 1119-1131, December 1976. 4 fig, 2 tab, 8 ref. OWRT A-052-KY(4).

Descriptors: *Water resources development, *Water supply, *Pricing, Effects, *Reservoir design, *Water demand, Conservation, Storage, Optimization, Benefits, Water policy, Water requirements, Water rates, Equations, Mathematical models, Systems analysis, Risks.
Identifiers: Benefit maximization.

A study was made, employing a deterministic price function and simulation analysis, to determine if benefits from water supply could be increased by utilizing price-usage information in reservoir design studies. Three pricing policies were examined. The first policy assumed no price-use relationship, and quantity demanded was based on existing community usage with a low water rate. The price of water was set to recover system costs. A price-use relationship was determined from the associated system which provided maximum expected net benefits. The third policy assumed the price-use relationship and the price charged for water during each billing period to be a nonlinear function of storage which increased as the amount of water in storage at the beginning of the period decreased. Results showed that the use of the conservation pricing policies substantially reduced storage requirements while providing demonstrable net benefits to the community and a large average supply. The policies substantially lowered the average price paid for water. The effect of uncertainty in consumer response to changes in price was studied using a probabilistic price-use relationship. This uncertainty did not significantly reduce the effectiveness of the conservation policy. In conclusion, demand management by the use of a proper pricing policy could significantly increase net water supply benefits to a community. (Bell-Cornell)
W77-05993

THE LAW OF DIFFUSED SURFACE WATER IN EASTERN RIPARIAN STATES,
Connecticut Univ., Storrs. School of Law.
For primary bibliographic entry see Field 6E.
W77-06042

RECENT DEVELOPMENTS IN THE RECOGNITION OF INSTREAM USES IN WESTERN WATER LAW,
Indiana Univ. at Bloomington. School of Law.
For primary bibliographic entry see Field 6E.
W77-06044

PREDICTIVE WATER DEMAND MODEL FOR CENTRAL AND SOUTHERN FLORIDA,
Central and Southern Florida Flood Control District, West Palm Beach. Resources Planning Dept.
N. Khanal.
Technical Publication No 76-2, April, 1976. 67 p, 15 tab, 4 append.

Descriptors: *Water demand, *Florida, *Forecasting, *Model studies, *Statistical models, Data collections, Analysis, Water resources, Water requirements, Equations, Seasonal, Variability, Environment, Economics, Rainfall, Utilities, Industrial water, Population, Pumping.
Identifiers: Consumers, Pumpage records, Scarcity.

A predictive water demand model has been developed, based on the social, economic and environmental parameters in the demand model for the central and southern Florida area. The model is validated by using the historic pumpage records for the three counties in the Gold Coast area. It has also been validated on municipal levels for urban areas which are in suburban counties. The coefficient of determination between the population served and the municipal water pumped is .892. When two other significant parameters, average rainfall/year and median family income, are incorporated in the demand model, the coefficient of determination is improved to .913. A marginal accuracy might be significant in the near future when scarcity of natural resources becomes critical. For the present, based on the results of this study, future water requirements can be predicted reliably if good population projections can be made for the above stated area. A second model has been developed based on the long monthly pumpage records of five large utility companies to estimate the seasonal variation of the average yearly water demand. (Martin-Florida)
W77-06047

6E. Water Law and Institutions

FLORIDA WATER RESOURCES LAW, A BIBLIOGRAPHY,
Office of Water Research and Technology, Washington, D. C.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 903, Price codes: A23 in paper copy, A01 in microfiche. Water Resources Scientific Information Center Report OWRT/WRSIC 77-200, January 1977. 323 p.

Descriptors: *Water law, *Florida, *Bibliographies, Legislation, *Legal aspects, Public rights, *Riparian rights, Water pollution, Judicial decisions.

This report, containing 290 abstracts, is another in a series of planning bibliographies in water resources produced from the information base comprising SELECTED WATER RESOURCES ABSTRACTS (SWRA). At the time of search for this bibliography, the data base had 101,774 abstracts covering SWRA throuth September 15, 1976 (Volume 9, Number 18). Author and subject indexes are included.
W77-05670

REGULATIONS AND WASTE CHARACTERIZATION,
Environmental Protection Service, Ottawa (Ontario).
For primary bibliographic entry see Field 5G.
W77-05709

IN SYDNEY: AID PLANNED FOR DEVELOPING COUNTRIES,
Geological Survey, Reston, Va.
L. A. Heindl.
Geotimes, Vol 21, No 12, p 23-24, December 1976.

Descriptors: *Conferences, *Technical societies, *International commissions, *Water resources development, Planning, Projects.
Identifiers: *Developing countries, *International aid.

The Association of Geoscientists for International Development conceived in August 1972 during the 24th International Geological Congress and established in May 1974 at the International Workshop on Earth Science Aid to Developing Countries, in St. John's, Newfoundland, held its first General Assembly on Aug. 15 during the 25th IGC in Sydney, Australia. AGID's program for the immediate future includes continued publication of its quarterly newsletter, AGID news; organization and sponsorship of symposiums, workshops, and short courses in Venezuela, Malaysia, Thailand, and Zambia; a directory of geoscience departments in Latin America, Africa, Asia (except for the Soviety Union and the People's Republic of China), and Oceania; compilation of post-1970 references on ground water in developing countries and a directory of ground-water information centers there; and a personnel data bank of geoscientists concerned with international development, based at first on AGID membership but adding others later. Other projects are still being planned or discussed; one of the most interesting is a series of case histories of international projects concerned with development of mineral and water resources in emerging countries. (Woodard-USGS)
W77-05758

PROCEEDINGS OF THE CONFERENCE ON SALT AND SALINITY MANAGEMENT,
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 5G.
W77-05934

ASSESSING PROGRAM IMPACT--WATER RESOURCES PLANNING ACT, TITLE III,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
D. L. Ingersoll.
Master of Science Thesis, 1975. 169 p, 16 tab, 78 ref, 4 append. OWRT C-5222(No. 4213)(2).

Descriptors: *Planning, *Water Resources Planning Act, *Grants, *Evaluation, *Arizona, U.S. Water Resources Council, Analysis.
Identifiers: *Title III(Water Resources Planning Act), *Bargaining models.

An evaluation conducted on the impact and effectiveness of the grant program authorized by Title III of the Water Resources Planning Act, which aids comprehensive planning of water and land use and development at the state level. A bargaining model is used to explain and analyze changes in planning capability due to federal funds. Specific effects of the grant program on Arizona's water resource planning are studied. Topics covered include the conceptual framework for policy analysis, methodology chosen for this thesis and sources of data; the history and development of federal assistance programs; the legislative background and administration of Title III programs as they relate to the other objectives of the act and the Water Resources Council; and national impacts of the grant program. A discussion of policy implications for the future is also presented. Arizona has developed a water planning agency capable of dealing with future water and land resource problems, having met nearly all the objectives of the Water Resources Council. This success was facilitated by Title III funding. (Jahns-Arizona)
W77-05989

THE NEW YORK WILD, SCENIC AND RECREATIONAL RIVERS SYSTEM ACT,
Columbia Univ., New York. School of Law.
P. L. Strauss.
Urban Law Annual, Vol. 1973, p. 137-48.

Descriptors: *Preservation, *New York, *Constitutional law, *Rivers, *Regulation, [illegible]lation, State governments, Condemnation, [illegible]ects, Condemnation value, Eminent domain, Value, Compensation, Social aspects, Economic impact, River regulation, Control, Property value, Real property, Planning, River systems.
Identifiers: *New York's Wild Scenic and Recreational Rivers System Act.

New York recently enacted the Wild, Scenic and Recreational Rivers System Act which will preserve approximately 165 miles of river. The act delineates three types of rivers: wild, scenic and recreational. Recreational rivers account for 20 miles of the system. They are valued chiefly for the opportunities for water recreation which they provide. Their banks may be made readily accessible, and developed with occasional towns and resorts. Scenic rivers account for about 67 miles of the system. Most are far from villages or vacation communities, yet they are more rural than wilderness. Limited road access is allowed as well as modest farming and forestry activity. Wild rivers are wilderness rivers, free-flowing and remote from civilization. Their only access is by water, foot or horse. The act is designed to accomplish its purpose by regulation and not condemnation. Condemnation proceedings will be used only when the act's effect prohibits a then existing use. The system raises possible constitutional problems. Landowners along scenic and wild rivers may find regulations prevent any type of useful development on their land. If the development had not been begun at the time the act was passed, no compensation is available. It is possible to view this as the taking of property without just compensation. It will be up to the New York courts to resolve this dilemma. (Moorhouse-Florida)
W77-06041

THE LAW OF DIFFUSED SURFACE WATER IN EASTERN RIPARIAN STATES,
Connecticut Univ., Storrs. School of Law.
C. Davis.
Connecticut Law Review, Vol. 6, No. 2, p. 227-245 (Winter 1974).

Descriptors: *Surface waters, *Surface runoff, *Riparian rights, *Water rights, *Permits, Surface-groundwater relationships, Agricultural runoff, Water law, Legislation, Surface water availability, Floods, Snowmelt, Rain water, Legal aspects, Common law, Judicial decisions, Administration, Water permits, Beneficial use, Reasonable use, Northeast US, Southeast US.
Identifiers: *Diffused surface water, Water rights(Non-riparians).

Recently hydrologists have urged that the almost unlimited right to use of diffused surface waters is inconsistent with the need to regulate our scarce water resources. Whether the rule permitting a landowner to capture and use waters before they reach a stream or lake grew out of an agricultural preference, flood-skimming, administrative convenience, or some combination of the above is of little importance. The concept that a landowner has a right to make beneficial use of waer diffused over his land is a basic legal doctrine in the United States further supported by many state statutory provisions which are examined herein. The contrasting doctrine of reasonable use applied to water taken from riparian streams is too restrictive, and only Florida and the Model Code place diffused surface waters within such a permit system. Mere assertion of general principles such as the interrelation of waters in the hydrologic cycle does not warrant abandonment of the functional beneficial use analysis of landowner's rights to diffused waters. The overwhelming number of structures already erected to catch such waters in reliance on the beneficial use doctrine further militates against any drastic changes. (Moorhouse-Florida)
W77-06042

MURKY WATERS: PRIVATE CLAIMS TO DEEP OCEAN SEABED MINERALS,
R. B. Frank, and B. W. Jenett.
Law and Policy in International Business, Vol 7, No 4, p 1237-1270 (Fall 1975).

Descriptors: *Oceans, *Mining, *International law, *Manganese, Mineralogy, Beds, Natural resources, Pacific Ocean, Treaties, Jurisdiction, Sites, Exploration, Dredging, Exploitation, International commissions, Continental shelf, Legislation, Technology.
Identifiers: *Manganese nodules, *Deep ocean mining, *Mineral rights, Licenses.

Mining of seabed minerals in the deep oceans is now feasible due to recent technological developments. Such mining would help reduce U. S. dependence on foreign countries for these minerals. However, the status of both international law and U. S. law with regard to deep sea mining is uncertain at the present time. The authors discuss an opinion, written by a law firm for a U. S. mining company, which states that there are already rules of international law which apply to deep sea mining operations. The opinion deals with the existence and nature of the right to claim exclusive mining rights in an extraterritorial seabed deposit, who may assert the right, and how the right may be acquired and effectively claimed. The authors also discuss the international agreements and domestic legislation that are required in order to provide incentive for private investments in deep sea mining operations. Any such laws should include strict standards for environmental protection. (Capehart-Florida)
W77-06043

RECENT DEVELOPMENTS IN THE RECOGNITION OF INSTREAM USES IN WESTERN WATER LAW,
Indiana Univ. at Bloomington. School of Law.
A. D. Tarlock.
Utah Law Review, Vol. 1975, No. 4, p. 871-903 (Winter 1975).

Descriptors: *Prior appropriation, *Beneficial use, *Diversion, *Reasonable use, Appropriation, Water law, Legal aspects, Water rights, Legislation, State governments, Permits, Unappropriated water, Consumptive use, Water policy, California, Idaho, Utah, Snake River, Administration, Federal government, Navigable rivers, Constitutional law.
Identifiers: *Instream uses, Western water law, Public trust doctrine.

Prior appropriation is theoretically inconsistent with public rights to instream waters. To resolve this dilemma, Western water law developed the theory that the state held water rights in public trust. State protection of minimum flows is necessary since private users have little incentive to appropriate water for instream uses when more profitable uses are available. State sovereignty and the exercise of state police power constitutionally justify a state's control over its water resources. State constitutions and codes in Western states require actual diversion, an intent to appropriate, and application to a beneficial use. However, recent cases have abrogated the actual diversion requirement by allowing natural diversions and later, instream appropriation. The barrier of beneficial use must still be overcome. Traditionally, instream uses have been less desirable, requiring large amounts of water and yielding little monetary return. One remedy is broad definition of beneficial use to include public interest in the quality of the environment. Alternatively, instream use can be protected by allowing appropriation permit denial on grounds recognizing public interest. Recent state environmental legislation often cites the impact on flow maintenance as a factor to be weighed in judging water rights applications. The federal government, possessing superior rights to water reservation, can complement state minimum flow programs by requiring minimum flows in any navigable river. (Moorhouse-Florida)
W77-06044

GROUND WATER PROBLEMS WITH OIL SHALE MINING IN THE PICEANCE BASIN,
Geological Survey, Denver, Colo. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-06045

POLLUTION FEES ARE FOR REAL IN FRANCE,
Lyon Water and Power Co. (France).
For primary bibliographic entry see Field 5G.
W77-06046

CALIFORNIA--'SAVING THE COAST',
For primary bibliographic entry see Field 6G.
W77-06048

ACHIEVEMENTS IN MARINE CONSERVATION, 1. MARINE PARKS,
International Union for Conservation of Nature and Natural Resources, Morges (Switzerland). Commission on Ecology.
For primary bibliographic entry see Field 5G.
W77-06049

LEGAL ASPECTS OF WATER POLLUTION CONTROL,
Imperial Government of Iran, Tehran.
For primary bibliographic entry see Field 5G.
W77-06050

PROPOSALS FOR IMPROVING THE MANAGEMENT OF INTERNATIONAL RIVER BASINS,
Cornell Univ., Ithaca, N.Y. Dept. of City and Regional Planning.
L. B. Dworsky.
In: Proceedings of the International Conference on Water Law and Administration, International Association for Water Law, February 8-14, 1976, Caracas, Venezuela; Published by the Commission for the National Water Resources Development Plan(COPLANARH), Caracas, Venezuela, p. 929-944, 1976. 10 ref.

Descriptors: *Watershed management, *River basins, *International joint commission, *Great Lakes region, Rivers, United Nations, International commissions, Environmental effects, Legal aspects, Political aspects, Water resources, *Canada, Treaties, Data collections, River basin development, River basin commissions, Optimum development plans, Governments, Jurisdiction, Land use, Water quality standards, *United States.
Identifiers: *River basin management, *La Plata Basin, *Great Lakes Basin.

The management of international river basins is of concern to the United Nations and to countries which share a common body of water. Cooperation between such countries could be facilitated through the establishment of international river basin commissions. The author discusses the problems encountered in the management of two international river basins: The Great Lakes Basin and the La Plata Basin. The Great Lakes Basin is managed by the International Joint commission of the United States and Canada (IJC). A Recent study recommended a new treaty apart from the IJC in order to improve management of the land and water resources of the basin. The author analyzes a proposal strategy for strengthening environmental management decision-making. This strategy was a result of the extensive studies done by the IJC. The La Plata Basin management experiment is evaluated in terms of the United Nations suggestions for integrated river basin management. The author recommends establishment of an experimental river basin center to serve as a prototype for other basins. (Capehart-Florida)
W77-06051

CLOSED-CYCLE MARICULTURE IN MARYLAND, VIRGINIA, AND DELAWARE: AN EXAMINATION OF THE ADAPTABILITY OF EXISTING FISHERY LAWS TO NEW TECHNOLOGY,
Delaware Univ., Newark. Sea Grant Program.
J. Bockrath, and D. Wheeler.
William and Mary Law Review, Vol 17, No 1, p 85-107, Fall 1975.

Descriptors: *Shellfish farming, *Commercial shellfish, *Aquiculture, Legislation, Fisheries, Natural resources, Artificial substrates, Oysters, Clams, Mollusks, Beds, Protection, Regulation, Bodies of water, State governments, Maryland, Virginia, Delaware, Chesapeake Bay, Fish harvest.
Identifiers: *Mariculture, Private waters.

Closed-cycle mariculture, the artificial cultivation of shellfish, is becoming commercially feasible. In some states, statutes regulating natural fisheries are flexible enough to allow the growth of artificial fisheries; in others, new legislation will be required. The authors examine the current status of legislation in Maryland, Virginia, and Delaware, three Chesapeake Bay area states. The Maryland and Virginia statutes may discourage development of the mariculture industry because the legislation regulating possession and harvesting of shellfish appears to apply to privately-owned waters as well as public waters. The authors suggest that Maryland and Virginia adopt new statutes if they wish to encourage closed-cycle mariculture development. The Delaware statutes apply only to specified waters and therefore, shellfish cultivation and harvest in private waters would not be regulated by statute. However, growth of the industry could be impeded by the state Department of Natural Resources which has almost unlimited discretion in regulating the shellfish industry. (Capehart-Florida)
W77-06052

ENVIRONMENTAL LAW--COMMERCE CLAUSE--CONGRESS MAY PROHIBIT THE DISCHARGE OF OIL INTO NONNAVIGABLE TRIBUTARY OF NAVIGABLE WATER ABSENT SHOWING THAT OIL REACHED AND POLLUTED NAVIGABLE WATER,
For primary bibliographic entry see Field 5G.
W77-06053

POST CARACAS: STRIKING A BARGAIN FOR SETTLEMENT AT GENEVA,
Columbia Univ., New York. School of Law.
R. G. Gardner.
Columbia Journal of Transnational Law, Vol. 14, No. 1, p. 3-19, 1975.

Descriptors: *Law of the sea, *Treaties, *International law, Legal aspects, Navigation, Oceans, Water law, Management, Penalties(Legal), Regulation, Water policy, Legislation, Oil, Exploitation, Exploration, Leases, Mining, Oil industry, Research and development, Administrative agencies, Foreign waters, Foreign trade, International waters, Economics, International commissions.
Identifiers: *Territorial sea, *Economic zone, Minerals.

Comments at the Law of the Sea Conference stressed the need for a multi-lateral treaty in the area of the traditional territorial sea. Suggested provisions for such a treaty include: a twelve-mile territorial sea; a 200-mile coastal state economic zone; a regime for exploitation of the deep seabed beyond the coastal state economic zone; compulsory dispute settlements to resolve problems of treaty interpretations; measures for domestic problems such as overfishing and exploitation of the deep seabed. Comments by Gordon Becker, indicated his desire for an authority in the deep seabed area which would assure nondiscriminatory access to areas of mineral wealth, especially oil and voting procedures which would offer protection against take-over by states seeking privileges unaccompanied by responsibility. Comments by Professor Jonathon Charney of Vanderbilt Law School centered upon regulation of the deep seabed. Discussion dwelled upon differences between the developed countries' wish for laissez-faire mining laws versus Group 77's desire for strong International Authority with wide discretion for the development or use of the deep seabed. (Hadoulias-Florida)
W77-06054

PROPOSED EFFLUENT GUIDELINES AND STANDARDS FOR PULP, PAPER AND PAPERBOARD POINT SOURCE CATEGORY.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06055

UREA AND AMMONIUM NITRATE; EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06056

CANNED AND PRESERVED SEAFOOD PROCESSING POINT SOURCE CATEGORY, EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, D.C.
For primary bibliographic entry see Field 5G.
W77-06057

UNITED STATES V NORFOLK DREDGING COMPANY ($3,000 PENALTY FOR MINOR OIL SPILL NOT EXCESSIVE).
6 ERC 2023-24 (ED Va July 9, 1974).

Descriptors: *Oil spills, *Georgia, *Penalties(Legal), *Coast Guard regulations, Oil pollution, Oil wastes, Water pollution sources, Waste water disposal, Oil, Oily water, Legal aspects, Legal review, Judicial decisions, Federal Water Pollution Control Act, Legislation, Federal government, Law enforcement, Water law.

The U. S. brought suit here to recover a $3,000 fine assessed against the defendant, an owner of a dredging vessel docked on the East River at Brunswick, Georgia. The fine was assessed after a Coast Guard vessel docked near defendant's and noticed an oily film on the water. The dredging company protested the fine. Upon review by the appropriate district court the fine was upheld. In reaching its determination the court concluded that the substance found by the Coast Guard upon the water was a combination of diesel oil and other petroleum products. It was also determined that the substance had come from the defendant's dredging vessel. Although it was claimed by defendant that lab test conducted on the oil did not conclusively tie it to his vessel, the court ruled that other evidence was sufficient to support the finding. Defendant also argued that the fine of $3,000 was excessive and cited other similar occurances imposing lesser fines. The court rejected all such arguments by claiming that the fine was a legitimate civil penalty under Section 33 of the Federal Water Pollution Control Act and was not unreasonable under these circumstances. (Moorhouse-Florida)
W77-06058

NATURE CONSERVANCY V MACHIPONGO CLUB, INC. (EFFECTS OF ACCRETION ON EASEMENT).
419 F. Supp. 390-405 (E.D. Va. 1976).

Descriptors: *Adjacent land owners, *Easements, *Accretion(Legal aspects), *Beaches, Right-of-

way, Trespass, Boundaries(Surfaces), Barrier islands, Deposition(Sediments), Recreation, Coastal marshes, Tidal marshes, Tides, Land tenure, Legal aspects, Seashores, Shores, Competing uses.

Plaintiff property owner sought damages and injunction against defendant-adjacent property owner for defendant's use of beach access easement over plaintiff's land on a barrier island, and to determine the right to use nearby marsh, meadowland and beaches. Plaintiff asserted ownership of the entire section of the island, including beaches and marshland to the ordinary low-water mark, but excluding a parcel owned by defendant. Defendant's predecessor-in-title was granted a 50 foot right-of-way bout 780 feet to higher beach. At the time of the controversy, continued expansion of the beach by accretion had lengthened the distance from defendant's parcel to the beach. The court held that the owner of an easement acquired the benefit of any accretion, as would a riparian landowner. Defendant's easement was extended to the present location of the beach. Defendant also alleged that marshlands and meadowlands were not subject to private ownership as alleged by plaintiff. The court indicated that such lands were originally owned by the state, but could be granted, and the the grant to plaintiff was defective. As a result of plaintiff's failure to prove specific damages, a nominal amount was awarded. (Molloy-Florida)
W77-06059

DRAINAGE DISTRICTS WITH COUNTIES OR CITIES (POWERS).
Kan. Stat. Ann. sec. 24-407 (Supp. 1975).

Descriptors: *Kansas, *Drainage districts, *Levees, *Legislation, Flood control, Flood protection, State governments, Local governments, River regulation, Taxes, Assessments, Operating costs, Rivers, State jurisdiction, Legal aspects, Economic impact, River beds, Dams.
Identifiers: *Kansas drainage districts, Kansas statutes.

Kansas has provided that each drainage district is a body politic and corporate. Such drainage districts are granted exclusive control of all lands lying between river banks at high water marks. All drainage districts shall have the power to: (1) adopt a seal; (2) sue and be sued; (3) purchase, hold and sell real estate; (4) regulate all natural watercourses; (5) control structures above the water; (6) construct and maintain levees; (7) fix, regulate and change the elevation of thoroughfares; (8) require railroads to raise tracks at points where levees intersect them; (9) maintain suits to enforce the orders of its directors; (10) maintain suits to determine possession of certain lands; (11) to levy and collect a tax on all taxable property within the district; (12) levy assessments and special taxes on property benefitted by certain levees in order to defray the cost; (13) issue negotiable bonds to pay costs of improving the channels or other activities of the district, provided such bonds are approved by a vote of the districts' taxpayers; (14) contract with other districts, units of government, and private corporations to improve waterflow that is hazardous beyond the immediate district; (15) contract to make effective all powers given the district; (16) do all acts necessary to carry out the districts' general powers, provided that certain enumerated procedures are followed. (Moorhouse-Florida)
W77-06060

WATER RIGHTS IN GENERAL.
NM Stat Ann secs 75-1-1 thru -6 (1968), as amended, (Supp 1975).

Descriptors: *Water permits, *New Mexico, *Prior appropriation, *Beneficial use, Legislation, Water rights, Water policy, Water management(Applied), Water law, Water transfer, Eminent domain, Right-of-way, Storage, Permits, Planning, Camping, Reservoirs, Priorities, Irrigation permits, Irrigation water, State governments.

New Mexico follows the doctrine of prior appropriation of water rights. Priority in time of the filing of a claim with the state engineer establishes the better right. The measure and limit of the right to the use of the water is based upon beneficial use. Waters appropriated for irrigation purposes are appurtenant to the specified lands unless the land owner contracts with ditch or reservoir owners for the storage or conveyance of such water. Claims established previous to New Mexico's adoption of prior appropriation should be filed with a statement declaring the date of first application to beneficial use, the continuity thereof, and a description of the land appurtenant to the water. The right of eminent domain is reserved to all persons who store or convey water for beneficial uses. Rights of entry are granted to engineers and surveyors. All sources of flowing water are subject to use by travelers. Camping and parking of trailers within three hundred yards of man-made water holes, water tanks or water wells without consent of the land owner is prohibited. (Josepher-Florida)
W77-06061

GIBBONS V GLOBE DEVELOPMENT, NEVADA, INC. (ADVERSE USE AND ADDITIONAL SUPPLY PRESENT FACTUAL QUESTIONS SUFFICIENT TO AVOID SUMMARY JUDGEMENT).
553 P.2d 1198-1200 (Ariz. 1976).

Descriptors: *Arizona, *Judicial decisions, *Prior appropriation, *Adverse possession, Legal aspects, Legal review, Streams, Water law, Water rights, Preferences(Water rights), Unappropriated water, Priorities, Water supply, Rain, Appropriation, Runoff, Surface runoff, Surface waters.
Identifiers: Rain Tank Wash, Injunctions(Prohibitory), Summary judgement.

Plaintiff corporation brought a declaratory judgement action seeking to obtain injunctive relief and to quiet title to its water rights in a rain tank wash and its tributaries. Defendants did not contest plaintiff's chain of title to the water rights in question, but did claim that through adverse possession, prior appropriation, or increased water supply they had acquired the right to take water from the wash. The trial court granted plaintiff's motion for summary judgement and the Court of Appeals affirmed. The Supreme Court of Arizona disagreed and found that material issues of fact did indeed exist. Defendants' claim of prior appropriation, however, was not such an issue. Defendants failed to show privity of estate or of contract between themselves and the party who allegedly filed a notice of appropriation of the disputed water in 1895. Defendants' contention of increased water supply did present the court with a factual issue as to whether a newly constructed runway at a nearby airport yielded additional runoff surface water, and provided new water in the wash for appropriation. In addition, defendants' argument that they had obtained a prescriptive right through adverse use had sufficient support to present the court with a triable fact. The court stated that neither proof of open, notorious, and hostile use, nor proof of use for a sufficient duration to create a prescriptive right are necessary to avoid summary judgement. (Moorhouse-Florida)
W77-06062

LIABILITY OF GOVERNMENTAL ENTITY FOR ISSUANCE OF PERMIT FOR CONSTRUCTION WHICH CAUSED OR ACCELERATED FLOODING,
D. Ytreberg.
62 ALR3d 514-17 (1975).

Descriptors: *Local governments, *Floods, *Construction, *Permits, *Negligence, Legal aspects, Water law, Regulation, Excavation, Governments, Legislation, Flood damage, Overflow, Accidents, Safety, Public health, Risks, Municipal water, Judicial decisions.
Identifiers: *Licenses, *Construction permits, Municipal government.

Ordinarily, where local government entities require licenses or permits as a prerequisite to the performance of certain acts, the government is not liable for injuries resulting from the licensees' negligent performance. More specifically, in issuing a construction permit, a city is merely exercising its governmental authority and, absent negligence in the issuance itself, is immune from liability for flooding caused or accelerated by the authorized construction. Governmental entities have not been found negligent for issuing construction permits to persons having a legal right to obtain them. This is true even when such construction imposes an additional burden on locally inadequate sewers and leads to worsening of flood conditions during heavy rains. Furthermore, where the construction permit is not issued for a nuisance or for the doing of something imminently dangerous, but for a proper and safe objective, the issuing entity is not liable for flooding caused by such construction. Clearly a municipality will suffer no liability if the injury directly results from the contractor's failure to follow the precise terms of the permit such as to the location of construction or the extent of excavation. Nor does authorization of construction specifying that the work be done in a prudent and lawful manner impose a duty on the government to oversee and accept responsibility for such construction. (Moorhouse-Florida)
W77-06063

DUCKETT V BROOKS (ADMISSIBILITY OF EVIDENCE SHOWING CONDITION OF LAND PRIOR TO PERIOD FOR WHICH DAMAGES ARE RECOVERABLE).
336 So.2d 1370-72 (Ala. Ct. Civ. App. 1976).

Descriptors: *Judicial decisions, *Overflow, *Obstruction to flow, Legal aspects, Water law, Legal review, Adjacent landowners, Streams, Floods, Streamflow, Flood damage, Erosion, Barriers, Riparian land, Riparian rights, Remedies, Damages, Dams.
Identifiers: *Statute of limitations, *Admissibility of evidence, *Evidence.

Plaintiff riparian landowner brought suit for damages arising from the overflow of water from adjoining creek. Defendant owned the land lying across the creek from plaintiff's property and the land on either side of the creek above plaintiff's property. Plaintiff complained that when defendant had cleared a portion of his land several years earlier, he had pushed trees and brush into the creek. After several heavy rains, the branches had washed down the creek until they accumulated, and in effect created a dam. Consequently, the water from the creek overflowed, eroding plaintiff's land. At trial, plaintiff was awarded $550 damages and defendant appealed. The court of civil appeals affirmed finding no error in the admission of evidence as to the condition of plaintiff's property after the obstruction of the creek and prior to one year before the institution of the suit. Defendant claimed the statute of limitations prohibited recovery for damages occurring more than one year before the suit, and thus evidence of conditions prior to that time was inadmissible. The court agreed that plaintiff could only recover for damages to his property occurring within the year prior to suit. The court went further, however, and held evidence of the condition of property and the effect of overflow caused by acts of defendant prior to the year before suit was admissible in order to show the condition of the land and the effect overflow had had on it at the beginning of the period for which damages are recoverable. (Moorhouse-Florida)
W77-06064

CITY OF CORPUS CHRISTI V NEUCES COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NO 3 (WATER IMPROVEMENT DISTRICT ALLOWED TO SUPPLY WATER FOR DOMESTIC USE TO NEIGHBORING TOWN).
540 SW2d 357-79 (Tex Ct Civ App 1976).

Descriptors: *Texas, *Dams, *Water rights, *Water supply, *Local governments, Dependable supply, Detention reservoirs, Multiple purpose reservoirs, Potential water supply, Water allocation, Water policy, Legal aspects, Water law, Adverse possession, Judicial decisions, Legal review, Prior appropriation, Adjudication procedure, Relative rights, Competing uses, Irrigated land.

This suit was instituted as a declaratory judgement action between the city of Corpus Christi, Texas and a water improvement district which supplied water to the city of Robstown, Texas. The matters sought to be determined were various and unrelated. Initially, the city of Corpus Christi claimed that the improvement district was authorized to supply water for irrigation and that their conversion to supplying domestic water was not permissible. The court ruled that the supplying of domestic water was an activity of higher priority and therefore permissible. The city also claimed a priority right to water previous to their wateruse certification in 1913 since they had constructed a dam in 1895 to stop the intrusion of salt water. This claim, too, was denied. The city then claimed the right to all water contained in Lake Corpus Christi attributable to the dam. The court reasoned that the mere fact of building a dam does not give one the right to all excess water created by it. Finally, the court disallowed the city's claim to the water by adverse use. (Moorhouse-Florida)
W77-06065

TRI-COUNTY LANDFILL COMPANY V ILLINOIS POLLUTION CONTROL BOARD (LANDFILLS POLLUTING WATERS TERMED HAZARDS).
353 NE2d 316-26 (111 Ct App 1976).

Descriptors: *Illinois, *Landfills, *Penalties(Legal), *Hazards, Water pollution, State governments, Administrative agencies, Waste disposal, Garbage dumps, Public health, Social aspects, Cities, Environmental sanitation, Sanitary engineering, Courts, Court decisions, Cases, Judicial decisions, Legal review, Legal aspects.
Identifiers: Illinois Pollution Control Board, Administrative regulations.

The Illinois Pollution Control Board found two landfill companies guilty of causing water pollution and causing a water pollution hazard. The Board ordered the companies to correct the harm caused and pay a $10,000 fine. The Appellate Court affirmed all parts of the board's order except the fine which it found excessive. Petitioners contended that the Board's jurisdiction extended only to navigable waters since the authorizing statute gave the Board control over all 'waters of this state'. The Court rejected this argument and ruled that 'waters of this state' means private as well as navigable waters. Petitioners next claimed that the Board should be estopped from acting against them since the Board's predecessor had certified their activity. The Court dismissed this contention reasoning that estoppel is not proper where a public right or public protection is involved. The Court noted that if this rationale were to be applied more stringent effluent standards could never be imposed because the operation was at one time certified under the then existing standards. (Moorhouse-Florida)
W77-06066

PEARSON V. CITY OF GUTTENBERG (CITY'S PROCRASTINATION IN DEVELOPING RIVERSIDE TRACT GIVE PRIVATE ADJACENT OWNER TITLE).
245 N.W.2d 519-33 (Iowa 1976).

Descriptors: *Iowa, *Mississippi River, *Adverse possession, *Real property, *Boundaries(Property), Riparian land, Legal aspects, Banks, Riparian rights, Water law, Boundary disputes, High water mark, Low water mark, Shores, Local governments, Judicial decisions, Legal review, Rivers.

Plaintiff-homeowners instituted a quiet title suit to establish their rights as riparian owners. Defendants, a municipal corporation, claimed that the strip of land immediately contiguous to the river was dedicated for use as a road and a public landing. Plaintiffs based their right to ownership on both record title and abandonment by the city or adverse possession. The claim of record title ownership turned on whether a 1848 plat, which did not give plaintiff title, or a 1905 plat, which did, would be recognized. The court ruled that all references to the land had been made pursuant to the 1848 plat, and therefore plaintiffs could not claim record ownership. The claim of adverse possession was partially granted and partially denied. The court divided the disputed land into two tracts. As to the upland tract, the court concluded that possession had been continuous, open and hostile, therefore, ownership was granted plaintiff. As to the lowland tract, the court noted that only minor improvements had been made, and members of the general public had utilized the tract for access to the water. Since possession was not exclusive, ownership to this tract was denied plaintiff. (Moorhouse-Florida)
W77-06067

MONSANTO COMPANY V ILLINOIS POLLUTION CONTROL BOARD (REQUIREMENTS FOR PETITIONING FOR PERMANENT VARIANCE FROM WATER POLLUTION REGULATIONS PERTAINING TO MERCURY DISCHARGE INTO PUBLIC SEWER SYSTEM).
350 NE2d 289-306 (111 App Ct 1976).

Descriptors: *Chemical wastes, *Mercury, *Illinois, *Administrative decisions, Industrial wastes, Heavy metals, Sewers, Chemical industry, Adjudication procedure, Administrative agencies, *Mississippi River, Waste disposal, Waste dilution, Permits, Water pollution sources.

Petitioner chemical company, which discharged varying amounts of mercury daily into the local sewer system and ultimately into the Mississippi River, sought to obtain review of a variance given it by defendant Illinois Pollution Control Board. Petitioner sought a permanent variance from Illinois regulations pertaining to mercury discharges. The Board granted a one-year variance limiting petitioner to both an average daily figure and a maximum figure. Petitioner then alleged it was not possible to comply with the variance since it was based on incorrect data, and that the Board's decision that it could only grant a one-year variance was incorrect. Remanding the decision for further consideration, the Illinois Fifth District Appellate Court found that in the absence of any evidence to support the Board's limiting figures in the variance, the Board could not justify its findings on a policy of 'tightening the noose' with respect to the daily discharge. The one-year variance limitation was construed to apply only to those dealing with correctible deviations, not those like petitioner's where the need for additional time was not the only barrier to compliance. (Molloy-Florida)
W77-06068

STATE OF NORTH CAROLINA V FEDERAL POWER COMMISSION (RIVERS DESIGNATED FOR POTENTIAL ADDITION TO THE SYSTEM UNDER THE WILD AND SCENIC RIVERS ACT).
533 F2d 702-10 (DC Cir 1976).

Descriptors: *Hydroelectric plants, *Dams, *Wild rivers, *Federal-state water rights conflicts, Social aspects, Administrative decisions, Electric power industry, Hydroelectric project licensing, Water levels, Federal Power Act, Pumped storage, North Carolina, River regulation.
Identifiers: *National Environmental Policy Act.

The state of North Carolina sought review of a permit granted to the Appalachian Power Company for a hydroelectric project on the New River. The principal objections to the project were failure to consider the alternative of energy conservation, inclusion of water storage capacity for downstream pollution dilution, costs, and the possibility that the river may become included in the National Wild and Scenic Rivers System. The procedural implications of the National Environmental Policy Act of 1969 were applied to North Carolina's presentation of these objections; consequently, the court found that the issues were adequately considered by the Federal Power Commission in granting the original permit. The Commission was not considered remiss in approving the project while the Interior Secretary was considering the state's application for inclusion of the river under the Wild and Scenic Rivers Act. The permit was modified to allow completion of archaeological excavation in the affected area. (Molloy-Florida)
W77-06069

AUSTIN V BEDFORD, IOWA, (CONFLICT IN CONVEYANCE RIGHTS AND USE OF DIRT FILL).
535 F2d 1064-67 (8th Cir 1976).

Descriptors: *Iowa, *Easements, *Flood control, *Channel improvement, Channels, Land tenure, Rivers, Contracts, Excavation, Legal aspects, Construction, Judicial decisions, Cities, Flood protection, Real property, Soils, Drainage.

Plaintiff contract buyers of three tracts of land sought damages from defendant city for breach of conveyance. The plaintiffs conveyed easements on each tract to the city to permit straightening of the river channel for flood control purposes. The plaintiffs contended that the city breached the terms of the coneyances by removing dirt from the plaintiffs' land. The plaintiffs further contended that the city had failed to spread the excess dirt in locations designated by the plaintiffs. The trial court held that the defendant had the right under the conveyance to use dirt excavated from the plaintiffs' land to fill the old river channel on another's property. The court also held that the city was not required to move dirt from one of the plaintiffs' tracts to another. The 8th Circuit Court of Appeals of the United States affirmed saying that the plaintiffs only had a right to dirt not needed to fill in the old channel. The court noted that the plaintiffs had failed to prove any damage from the city's actions. (Capehart-Florida)
W77-06070

CORPORATE POWERS IN DRAINAGE AND IRRIGATION OPERATIONS.
Tex Rev Civ Stat Ann arts 1525 to 1526 (1962).

Descriptors: *Texas, *Canals, *Drain, *Ditches, *Land development, Legislation, Drainage, Contract administration, Flumes, Laterals, Dams, Reservoirs, Lakes, Wells, Irrigation, Mining, Milling, Land management, Land use, Natural resources, Land forming.
Identifiers: Corporations, *Stock raising.

Corporations chartered for the purpose of constructing, maintaining and operating canals, drains and ditches outside the corporate limits of cities and towns in any county in Texas, shall have power to, acquire lands for drainage, and may alienate such lands within fifteen years. These corporations may also contract for the permanent drainage of any tract of land, borrow money for construction, maintenance and operation of ditches, canals, and laterals, and make appropriate

reports to the commissioners court of the county. Corporations which are organized to construct, maintain and operate canals, flumes, feeders, laterals, dams, reservoirs, lakes and for storing and transferring water to those people entitled to use the water for specified purposes shall have power to acquire lands by voluntary donation, or with stocks or bonds. These lands may be held, improved, subdivided or disposed of. (Hadoulias-Florida)
W77-06071

POWERS RESPECTING FLOOD CONTROL.
Tex Rev Civ Stat Ann art 1581e (1962).

Descriptors: *Texas, *Eminent domain, *Flood control, *Drainage, Legislation, Condemnation, Canals, Drains, Levees, Easements, State governments, Local governments, Legal aspects, Political aspects, Social aspects, Public access, Right-of-way, Public rights, Public canals, Public utilities, Legal review, Contract administration.

The right of eminent domain can be exercised by all counties in the state of Texas, for the acquisition or condemnation of all real property, easements and rights-of-way over public and private lands for flood control, drainage and water outlet purposes. However, the counties may not condemn the fee of, as distinguished from taking an easement or right-of-way overm, across or upon any property lawfully used by any public utility, railroad, canal, levee or other unit devoting its property to a public use. Appeals from finding or assessments of damages will not suspend any flood control works upon such condemned or acquired property. In addition, the Commissioners Court of any county may contract with the governing bodies of various political subdivisions for the joint acquisition of rights-of-way, or joint construction or maintenance of canals, drains and other improvements for flood control and drainage. (Hadoulias-Florida)
W77-06072

GLENDO RESERVOIR; GENERAL PROVISIONS.
Wyo Stat Ann secs 41-1 thru 41-1.11 (1959), as amended (Supp 1971).

Descriptors: *Reservoir construction, *Wyoming, *Land reclamation, *Nebraska, Legislation, Reservoirs, Water storage, Irrigation practices, Flood control, Land management, Unappropriated water, Obstructing to flow, Reasonable uses, Diversion, Water utilization, Administration, Regulation, Water law, Institutions, Interstate, State governments, Water policy, Water management(Applied), Water resources, Power operation and maintenance, Powerplants, Silts, Federal government, Governmental interrelations.
Identifiers: *Glendo Reservoir, *North Platte River.

The United States bureau of reclamation is permitted by the legislature of Wyoming to construct the Glendo Reservoir, and to store water of Wyoming from the North Platte River, for the irrigation of lands in Wyoming and Nebraska for development of power, flood and silt control, subject to the restrictions that the Wyoming state engineer considers necessary to protect state water rights. The 1971 Amendments set forth specific duties and powers of the state engineer for this purpose. Thus, the state engineer is responsible for the coordination of Wyoming water and related land resources planning, and is authorized to accept federal funds for the development of a state water and related land resources plan. He can rule upon applications for use of underground water sought to be appropriated or diverted in Wyoming for use in an adjoining state, and he can act if conditions develop which interfere with the natural flow of any thermal spring. In addition, a library of water resources will be collected and kept in the office of the state engineer, of books and technical papers, which are presently in the possession of state libraries and universities. (Hadoulias-Florida)
W77-06073

WATER RIGHTS.
Utah Const. art 11, sec 6 and art 17, sec 1.

Descriptors: *Utah, *Cities, *Municipal water, *Water works, *Water rights, Water sources, Reasonable use, Prior appropriation, Legal aspects, Water law, Preferences(Water rights), Regulation, Water allocation(Policy), Water transfer, Water utilization, Water distribution(Applied), Water rates.

No municipal corporation in Utah, shall directly or indirectly, lease, sell, alienate or dispose of any waterworks, water rights or sources of water supply now, or hereafter to be owned or controlled by it. All such waterworks, water rights and sources of water supply now owned or hereafter to be acquired by any municipal corporation, shall be preserved, maintained and operated by it for supplying its inhabitants with water at reasonable charges. Nothing herein shall be construed to prevent any such municipal corporation from exchanging water rights, or sources of water supply, for other water rights or sources of water supply of equal value, and to be devoted in like manner to the public supply of its inhabitants. All existing rights to the use of any of the waters in Utah for any useful or beneficial purpose are hereby recognized and confirmed. (Rieck-Florida)
W77-06074

TREATIES CONCERNING COLORADO RIVER,
Utah Code Ann secs 73-13-1 thru-12 (1968).

Descriptors: *Utah, *Mexican water treaty, *State governments, Rivers, Water allocation(Policy), Interstate compacts, *Colorado River, *Colorado River Basin, Arizona, Colorado, New Mexico, Wyoming, Treaties, Legislation, Administrative agencies, Water resources development, River basin development, Mexico, State jurisdiction, Governmental interrelations.
Identifiers: *Upper Colorado River Basin Compact, Colorado River Committee.

The Colorado River Committee was formed to investigate and study the effects of the treaty of 1944 between the United States and Mexico, and to make a study of ways and means of utilizing the waters of said river allocated to Utah. In addition, an interstate treaty for apportionment of Colorado River waters was ratified assigning percentages of total consumptive use to each state. The treaty, known as the upper Colorado River Basin Compact, provides for use of water in excess of that apportioned and the storage of water in reservoirs. An administrative agency was created by the interstate treaty, with power to adopt rules, gauge the water levels, study the water supply and its uses, and report to the states involved. Provisions are also included for the construction and funding of facilities, conformation with other treaties, apportionment of other smaller rivers and tributaries under preexisting rights, and storage of water in various states for other states' use. Imported water is not included under the treaty, and failure to use the apportioned amount of water is not a relinquishment of the right to that amount. The interstate treaty is subject to federal laws and the 1944 treaty between the United States and Mexico. (Molloy-Florida)
W77-06075

UNITED STATES V STATE OF FLORIDA (DETERMINING FEDERAL VERSUS STATE'S RIGHTS IN LANDS, MINERALS AND RESOURCES UNDERLYING THE ATLANTIC OCEAN AND GULF OF MEXICO),
96 S Ct 1840-41 (1976).

Descriptors: *Ownership of beds, *Water resources development, *Natural resources, *Florida, Coasts, *Continental shelf, *Atlantic Ocean, *Gulf of Mexico, Marine geology, Federal-state water rights conflicts, Relative rights, Beds under water, Mineral industry.
Identifiers: *Coastal waters, Coastal zone management.

Plaintiff federal government sought declaration of rights as against defendant state government to natural resources in ocean submerged lands. After reports by a master and a special master, the United States Supreme Court decreed that the State of Florida is entitled to all lands, minerals and other resources within an area three geographic miles from the Atlantic coastline and within three marine leagues from the Gulf of Mexico coastline. The United States was found to be entitled to all resources underlying the Atlantic beyond the Florida limit to the continental shelf edge and to all resources beyond the Florida limit in the Gulf of Mexico. For purposes of the decree Florida Bay and areas of water within the Dry Tortugas Islands, the Marquesas Keys, and the Lower Florida Keys are not inland waters. (Comer-Florida)
W77-06076

BRIZENDINE V NAMPA MERIDIAN IRRIGATION DISTRICT (DUTY TO MAINTAIN CANAL),
548 p2d 80-90 (Idaho 1976).

Descriptors: *Idaho, *Legal review, *Flood damage, *Negligence, *Embankments, Canal construction, Canals, Canal seepage, Canal embankments, Legal aspects, Judicial decisions, Water control, Damages, Rivers, Irrigation districts.
Identifiers: Absolute liability.

Plaintiff landowners sought damages from defendant, the Nampa-Meridian Irrigation District, for injury to property caused when the district's irrigation canal bank broke, flooding the plaintiffs' properties. The plaintiffs alleged that the break was caused by the district's negligence. The trial court found that the doctrine of res ipsa loquitur was applicable and, thus, that the district was negligent in failing properly to maintain the canal. The court also ruled that the defendant was not liable under a theory of absolute liability in tort. On appeal, the Idaho Supreme Court ruled that res ipsa loquitur can be applicable in a case where impounded waters have escaped, and that specific notice of leakage need not have been given to the district before the break. However, since the district was not a 'public corporation' within the purview of the Idaho Tort Claims Act, the case was affirmed in part, reversed in part, and remanded. (Frank-Florida)
W77-06077

WATERS; PENALTIES, VIOLATIONS,
Utah Code Ann 76-10-201 thru -204 (Supp 1975).

Descriptors: *Utah, *Penalties(Legal), *Law enforcement, Structures, Dams, Bridges, Administration, Stream flow, Water allocation(Policy), Legal aspects, Water rights, Obstruction to flow, Lumbering, Regulation, Competing uses, Distribution, Planning, Preferences(Water rights), Water control.
Identifiers: *Criminal penalties.

Any person who interferes with the flow of water in a stream under the control of a water commissioner in the state of Utah is guilty of a misdemeanor. Similarly guilty is any person who takes water out of a ditch or canal unless it has been duly distributed to him. Furthermore, any person who uses a greater quantity than has been duly distributed to him, or changes the flow, or who willfully injures any dam or other means of diverting or conveying water is guilty as well. A person who floats timber down a stream and al-

lows it to accumulate or obstruct watergates for diverting the water is also guilty of a misdemeanor. Any person who willfully and maliciously injures or destroys any structure erected to create hydroelectric power, drain land, or conduct water for irrigation or other water supply is guilty of a felony. Any person who makes an aperture in a dam or embankment, or who damages a securing piling, is likewise guilty of a felony of the third degree. (Molloy-Florida)
W77-06078

OBSTRUCTIONS IN STREAMS,
Kan Stat Ann secs 82a-301 thru -314 (1969), as amended (Supp 1975).

Descriptors: *Kansas, *Obstruction to flow, *Alteration of flow, *Dams, Currents(Water), Streams, Diversion, Banks, Channels, Maintenance, Maintenance costs, Cleaning, Dam construction, Streamflow, Flood plains, Watercourses(Legal aspects).

It shall be unlawful for any person, partnership, association, corporation or political subdivision to construct or alter any dam or other water obstruction, or to change or diminish in any manner the course, current or cross section of any stream within the state of Kansas without previously obtaining the written consent of the cheif engineer. Any violation of this act shall constitute a misdemeanor punishable by a fine not to exceed one thousand dollars. Upon petition of fifty taxpayers owning land in the floodplain of a river in any county, the board of county commissioners of each county is authorized to clean and maintain the banks and channels of the streams and watercourses in their respective jurisdictions. Any expenses incurred in removing any obstructions in the streams, or damage to private property, shall be paid out of the general fund of the respective counties, Any landowner or operator who desires to construct, or who has constructed a dam, as part of the federal agricultural conservation program without complying with the provisions of this act may make application to the chief engineer to obtain approval for the construction of such dams. (Hilburn-Florida)
W77-06079

MCNAMARA V. WESTVIEW BUILDING CORPORATION (LAND OWNER'S RIGHTS AGAINST DRAINAGE FROM ABUTTING PROPERTY).
357 N.E.2d 777-79 (Mass. App. 1976).

Descriptors: *North Dakota, *Drainage systems, *Drainage water, Flow, Permits, Surface drainage, Surface runoff, Surface waters, Ditches, Natural flow, Legal aspects, Channel flow, Water law, Channels, Judicial decisions, Discharge(Water).
Identifiers: *Licenses.

Plaintiff sought to enjoin defendant from draining water from the defendant's abutting property onto the plaintiff's real estate. In the process of subdividing its land the defendant requested and received a written license from the plaintiff to discharge surface water into a drainage ditch on the plaintiff's land. In consideration of the granting of the license, the defendant agreed to open and clear out the drainage ditch. Thereafter, water discharged by defendant's drainage system entered the ditch and flowed through it into a marsh; from the marsh the water followed a natural channel into a pond. The plaintiff requested that the defendant clean out the natural channels, but the defendant refused, and the plaintiff revoked the license. The Superior Court, Norfolk County, entered a judgement dismissing the action, and the plaintiff appealed. The Appeals Court held that because the flow of surface water onto the plaintiff's land was not materially changed, and no damage had resulted from defendant's acts, the plaintiff had no basis for complaint and therefore was not entitled to injunctive relief. (Hilburn-Florida)
W77-06080

UNITED PLAINSMEN ASSOCIATION V. NORTH DAKOTA STATE WATER CONSERVATION COMMISSION (CONSERVATION PLANNING RESPONSIBILITY OF STATE ENGINEER PRIOR TO ISSUING WATER PERMITS).
247 N.W.2d 457-64 (N.D. 1976).

Descriptors: *North Dakota, *Water allocation(Policy), *Water policy, Conservation, Water management(Applied), Management, Legal aspects, Industrial water, Water demand, Water law, Water, Water resources development, Water utilization, Water permits, Comprehensive planning, Administration, Legislation.
Identifiers: *Public Trust Doctrine, Conservation planning.

Plaintiff, a non-profit corporation, sought to enjoin the State Water Conservation Commission and State Engineer from issuing future water permits for coal related power and energy production facilities until there was a comprehensive short-term and long-term plan for the conservation and development of the state's natural resources, which the plaintiff contended is required by state statute and the common law Public Trust Doctrine. The District Court dismissed the complaint for the failure to state a claim upon which relief could be granted, and the plaintiff appealed. The Supreme Court held that the state statute entitled 'declaration of state water resources' did not impose mandatory planning responsibility upon the State Engineer which constituted a condition precedent to issuance of temporary or permanent water permits. The discretionary authority of state officials is circumscribed, however, by the 'Public Trust Doctrine' wich requires, at minimum, determination of te potential effect of allocation of public water on present water supply and future water needs of the state. Therefore, the amended complaint charging failure to devise any water conservation plan, as well as failure to consider injury to public, stated a claim upon which relief could be granted. (Hilburn-Florida)
W77-06081

SAND AND GRAVEL (TAKING MATERIALS FROM RIVERS AND ISLANDS BELONGING TO THE STATE).
Kan Stat Ann secs 70a-101 thru 116 (1972), as amended, (Supp 1975).

Descriptors: *Kansas, *River beds, *Rivers, *Islands, *Legislation, Earth materials, Gravels, Sands, Channels, Boundaries(Property), Compensation, State governments, Payment, Hay, Natural resources, Regulation, Water law, Legal aspects.

It shall be unlawful for any person, partnership or corporation to take from within or beneath the bed of any river which is the property of the state of Kansas any sand, oil, gas, gravel or mineral, or any natural product whatsoever from any lands lying in the bed of any such river or any hay, timber or other product, unless upon such terms of payment to the state and under such terms and conditions as the director of taxation may determine to be just and proper. The secretary of revenue is authorized to make and publish all rules, terms and conditions for the taking, purchasing or selling of the articles and products mentioned above. The proceeds derived from the sale of any state property shall be credited to the sand-royalty fund, out of which all necessary and reasonable expenses incurred by the director of taxation shall be paid. Any person or corporation violating this act shall be guilty of a misdemeanor. (Hilburn-Florida)
W77-06082

NAVIGABLE WATERS (AQUISITION, TITLE AND CONVEYANCE).
Kan Stat Ann secs 82a-201 thru -205 (Supp 1975).

Descriptors: *Kansas, *Ownership of beds, *Streams, *Stream beds, Streamflow, Channels, Navigable waters, Legal aspects, Condemnation, Compensation, Water, Bodies of water, Avulsion, Floods, State governments, Channel flow, Legislation.

Whenever the channel, or any part thereof, of any navigable stream in the state of Kansas has been suddenly changed or altered by such stream establishing a new channel by flood or avulsion, the secretary of state shall procure the fee title to such new channel, by purchase or by condemnation proceedings. As soon as practicable, the secretary of state shall enter into negotiations with the owner of the title to such new channel for purpose of conveying title in fee to the stae. No sum shall be paid for the new channel in excess of the net amount realized from the sale of the corresponding abandoned channel. In the event that the secretary of state and the owner cannot agree upon a purchase price, the secretary of state shall institute condemnation proceedings. If the amount of money necessary to purchase the new channel, as ascertained by the condemnation proceedings, shall exceed the net amount realized from the sale of the corresponding abandoned channel, the secretary of stae shall abandon the condemnation proceedings and be relieved from further duty to obtain title to the new channel. (Hilburn-Florida)
W77-06083

6F. Nonstructural Alternatives

FLOOD PLAIN MANAGEMENT THROUGH ALLOCATION OF LAND USES -- A DYNAMIC PROGRAMMING MODEL,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
Lewis D. Hopkins, E. Downey Brill, Jr., Jon C. Liebman, and Harry G. Wenzel, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 899, Price codes: A03 in paper copy, A01 in microfiche. Illinois Water Resources Center, Urbana, Research Report No. 117, 1976, 42 p. 4 fig, 4 tab, 31 ref, 1 append. WRC S-052-ILL.

Descriptors: *Flood protection, *Land use, Economic efficiency, *Welfare(Economics), *Optimum development plans, *Dynamic programming, Flood routing, Urbanization, Optimization, Flood plains, Non-structural alternatives, *Land management, Economic rent, *Flood plain zoning, Zoning, *Model studies.

Despite heroic structural measures, flood damages continue to rise. This research develops a means for identifying more nearly optimal patterns of land use with particular reference to timing, depth, and duration of flooding. The major premise is that flood plain management is best viewed as a problem of allocating land uses to land parcels. A dynamic programming model is developed to determine what combination of downstream uses, which require flood protection, and upstream uses, which may increase runoff or provide protection through longer water retention, should be encouraged. The dynamic programming model and an associated simplified routing technique are demonstrated on a real watershed. Desirable extensions of the model are identified. One major result of the project is the realization of a need to classify watersheds by the degree of effective interdependence among land use decisions so as to determine the most appropriate types of analytical models and public sector interventions for particular cases. Thinking about flood management as a problem of land use allocation is shown to be a fruitful conceptualization for exploring the issues, for developing models, and for identifying appropriate public sector interventions.
W77-05720

PROCEEDINGS MISSISSIPPI WATER RESOURCES CONFERENCE 1976.
Mississippi State Univ., Mississippi State. Water Resources Research Inst.
For primary bibliographic entry see Field 4A.
W77-06084

COMMUNITY SELF-HELP RIVER FORECAST PROCEDURES,
National Weather Service, Atlanta, Ga. Southeast River Forecast Center.
For primary bibliographic entry see Field 4A.
W77-06086

6G. Ecologic Impact Of Water Development

AQUATIC ENVIRONMENTAL QUALITY: TOXICOLOGY,
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
For primary bibliographic entry see Field 5C.
W77-05608

AQUATIC ENVIRONMENTAL QUALITY: PROBLEMS AND PROPOSALS,
Fisheries and Marine Service, Ottawa (Ontario). Oceanography Branch.
H. H. Harvey.
Journal of the Fisheries Research Board of Canada, Vol. 33, p. 2634-2670, 1976. 5 fig., 3 tab., 78 ref.

Descriptors: Aquatic environment, *Environmental effects, Ecology, *Environmental control, Research and development, *Testing, *Monitoring, Water quality control, Waste water(Pollution), Sewage effluents, Recreation wastes, Universities, Agriculture, Ethics, Forestry, Mining, Mercury, Land management, Data collections, Data processing, Hydroelectric power, Fossil fuels, Nuclear reactors, Transportation, *Canada.
Identifiers: *Environmental impact, *Environmental assessment, *Canadian programs.

An overview of research and monitoring of environmental quality by federal and provincial agencies, the university, and private sectors was presented. The overall effort in Canada was found to be unbalanced. Monitoring of water quality, chemical water quality, and fish physiology-toxicology were found to be areas of strength. Areas of weakness were the use of organisms and the use of whole systems as indicators of environmental quality. In some areas of monitoring, data interpretation lagged seriously behind data collection. Under utilization of the university community was reflected, in some part, by the relative lack of innovation in environmentally related problems. A number of constraints were found to exist in the underdstanding of the source, distribution, and life expectancy of toxic substances in the environment. These were discussed in relation to mercury. Specific problems of aquatic environmental quality were discussed in relation to economics. (Katz)
W77-05636

POST-IMPOUNDMENT EFFECTS OF REGULATED FLOWS FROM DWORSHAK DAM ON THE BENTHIC INSECT COMMUNITY OF THE CLEARWATER RIVER, IDAHO,
Idaho Univ., Moscow. Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W77-05725

THE ENVIRONMENT OF SOUTH FLORIDA, A SUMMARY REPORT,
Geological Survey, Miami, Fla. Water Resources Div.
B. F. McPherson, G. Y. Hendrix, H. Klein, and H. M. Tyus.
Available from the Branch of Distribution, USGS, 1200 S. Eads St., Arlington, VA 22202, Price $3.65. Professional Paper 1011, 1976. 82 p, 27 fig, 98 ref.

Descriptors: *Land development, *Environmental effects, *Water quality, *Ecosystems, *Florida, Urbanization, Agriculture, Drainage, Wetlands, Aquatic environment, Water levels, Canals, Marshes, Hydrologic aspects, Surface waters, Groundwater, Evaluation.

Man has altered the original south Florida ecosystem to a new three-part ecosystem which incorporates an agricultural component, an urban component, and a component of the original ecosystem that is largely unchanged but still has been affected by man. These components are interrelated through the flow of energy and material. The ecosystem of south Florida has undergone extensive alteration for 70 years. About 35 percent (3,000 square miles) of the original habitat of the ecosystem has been replaced by agriculture or urbanization. The remaining natural habitat is stressed by exotic plants and animal, changes in water levels and flows, severe fires, pollution, loss of animal and plant populations, and by further growth and development. Man's most dramatic and long-term effects on the ecosystem have resulted from drainage. Wetlands originally occupied about 75 percent of south Florida; through the years large areas of this land have been drained. In parts of southeast Florida, drainage has lowered water levels 5 to 6 feet below the 1900 level and stressed natural systems. (Woodard-USGS)
W77-05738

AQUATIC HABITAT INVENTORY IN THE HOT DESERT EIS AREA, UTAH,
Brigham Young Univ., Provo, Utah. Center for Health and Environmental Studies.
R. N. Winget, and M. K. Reichert.
Final Report, Aug 9, 1976. 117 p., 39 tab. 3 fig, 10 plates, 7 ref, 4 append. BLM YA-512-CT6-77.

Descriptors: *Watershed management, *Benthos, *Stream improvement, *Water quality, *Coliforms, Bank stability, Land management, Grazing, *Utah, Cutthroat trout, *Aquatic habitats, Surveys, Reservoirs, *Deserts, Invertebrates, *Baseline studies, Arid lands, *Environmental effects, Streams, Vegetation.
Identifiers: *Environmental impact evaluation, National resource lands, Critical aquatic habitat, Pure strain cutthroat trout, Grazing impacts, BLM administered streams, BLM stream surveys, *Hot desert EIS area(Utah).

These surveys were to provide aquatic habitat and water quality baseline data to be used in evaluating quality of aquatic resources in relation to grazing use of national resource lands. This study covered 14 streams and 14 reservoirs in the Hot Desert EIS designated area of southwestern Utah. Included in the analyses are: descriptions of existing aquatic habitats; characterizations of macroinvertebrate communities; and water quality for the date of sampling. Preliminary analyses indicate that riparian vegetation comprises one of the most critical components of quality aquatic habitat in hot desert streams and reservoirs. Due to sparsity of vegetation on most desert lands, stream riparian communities are highly desirable to grazing animals and thus are often highly impacted. Extreme flows are the next most serious environmental perturbation but one which generally has little chance of being controlled.
W77-05855

ENVIRONMENTAL IMPACTS OF LAND USE CHANGE,
Hawaii State Dept. of Planning and Economic Development, Honolulu. Research and Economic Analysis Div.
P. J. Schwind.
Journal of Environmental Systems, Vol. 6, No. 2, p 125-145, 1967-77. 4 fig, 1 tab, 16 ref.

Descriptors: *Land use, *Environmental effects, *Evaluation, Planning, Economics, Water resources, *Hawaii, Costs, Benefits, Decision making, Systems analysis, Analytical techniques, Agriculture, Conservation, Flooding, Groundwater, Erosion, Sedimentation, Air pollution.
Identifiers: *Environmental impact analysis, *Matrix method, Peak stream discharge, Groundwater consumption, Groundwater recharge loss.

Better measurement and analysis of environmental impacts are prerequisites to better land use planning. Developed is an empirical matrix method for expressing the environmental impacts of land uses in a form compatible with economic evaluation techniques such as cost-benefit analysis. Impacts are first measured in standarized physical units, then converted to monetrary value, modified by the locationally variable effects of several land characteristics, and finally summed into composite impact cost estimates. Thre presentation emphasizes the preparation of the kind of data required to operate the method. In a case study example from Hawaii, the method is applied to calculate the environmental impact costs of three alternative land uses at each of three proposed development sites. The methodology combines the strengths of three kinds of techniques. In Step One, a 'unit price' is applied to each environmental impact's average rate of occurrence in physical units per acre, to give the average impact cost per acre by land use. This step is accomplished as Matrix A (Cost per Impact Unit by Impacts) is multiplied by Matrix B (Impacts by Land Use) to give Matrix C (Impact Costs by Land Use). In Step Two, a set of locational weighting factors is produced to adjust the average impacts for the effects of the land characteristics at each location. In Step Three, the final matrix of composite impact cost for each land use at each location is the result of multiplying the products of Step One and Step Two. The problems considered include peak discharge, groundwater recharge loss, and groundwater consumption. (Bell-Cornell)
W77-05922

THE AMERICAN EXPERIENCE,
National Science Foundation, Mosaic, Vol. 8, No. 1, p 36-42, January/February, 1977.

Descriptors: *Arid lands, *Deserts, *Grazing, *Water management(Applied), *Grasslands, Desert plants, Cattle, Pasture Management, Livestock, Carrying capacity, Conservation, Vegetation, Ranges, Ecology, Biomes, Model studies, Southwest U.S., Water conservation, Water allocation(Policy), *Ecosystems, *History, Computer models.

In the 1870's, fragile, water-poor ecosystems were little understood and much abused. A century later, understanding has improved; abuses continue. A historical perspective is presented which outlines the early overuse, especially overgrazing, of the desert ecosystems of the southwestern United States. In the 19th century from 200 to 250 head of cattle per square mile were grazed on areas that had the capacity to handle from 50 to 100. The desert could not support such intensive use, and the vegetation that nourished the livestock began to disappear. The problems which existed then continue today. Water is being used faster than it can be replenished. Planning for water use in the future of the area is discussed, and use of computer models to aid in the solving of the problems of overuse of the desert and its resources is evaluated. (Jamail-Arizona)
W77-05941

THE RESPONSE EQUATION METHOD: A NEW ROLE FOR SIMULATION OF ENVIRONMENTAL SYSTEMS,
Cornell Univ., Ithaca, N. Y. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W77-05978

AN HIERARCHICAL GOAL PROGRAMMING APPROACH TO ENVIRONMENTAL-LAND USE MANAGEMENT,
Texas Univ. at Austin.
A. Charnes, K. E. Haynes, J. E. Hazleton, and M. J. Ryan.
In: Mathematical Analysis of Decision Problems in Ecology (Proceedings of the NATO Conference, Istanbul, Turkey, July 1973), Vol. 5 of Lecture Notes in Biomathematics. A. Charnes & W. R. Lynn, Eds., Springer-Verlag, Berlin, 1975, p 2-13. 2 fig.

Descriptors: *Texas, *Coasts, *Environmental effects, *Economic impact, *Evaluation, *Methdology, Management, Decision making, Mathematical models, Equations, Water resources, Water allocation(Policy), *Land use, Input-output analysis, Constraints, Water quality, Systems analysis.
Identifiers: *Hierarchical goal programming, Ports, Three-level model, Minimization.

The specific goals of this study are: (1)the establishment of operating criteria which are specific to the Texas Coastal Zone; (2) development of a methodology or systematic approach for evaluating the economic and environmental effects of alternative policies for Texas Coastal Zone management; and (3) the testing of the systematic approach by application of several hypothetical management policies to a specific region of the Texas Costal Zone. Part of the past year's efforts focused on the quantitative evaluation of the various land and water environmental units within the Texas Coastal Zone; particular emphases was upon the establishment of water quality criteria for maintenance of biological life in estuaries. The second objective during the past year was development of the various components of a sytematic approach. A regional economic input-output model and a demographic model were developed in conjunction with land use models for spatial allocation of projected industries and households. Water demands and residuals generation along with associated treatment and costs also were established for the region. A major objective of the study's second year is to integrate the various components of the methodology. Further testing of the method's evaluative ability will be undertaken; to demonstrate is aplicability, two realistic, but hypothetical coastal management schemes have been chosen for evaluation. (Bell-Cornell)
W77-05979

MODELS IN BIOLOGICAL WASTEWATER TREATMENT: OBJECTIVES, RESULTS, APPLICABILITY,
Technische Hogeschool Twente, Enshede (Netherlands). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W77-05980

BIOLOGICAL FILTER DESIGN OPTIMIZATION,
Northwestern Univ., Evanston, Ill. Technological Inst.
For primary bibliographic entry see Field 5D.
W77-05981

MEASUREMENT OF ENVIRONMENTAL TRADE-OFFS AND PUBLIC POLICY: A CASE STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
D. Pendse, and J. B. Wyckoff.
Water Resources Bulletin, Vol. 12, No. 5, p 919-930, October 1976. 2 fig, 3 tab, 22 ref. OWRT B-017-MASS(6).

Descriptors: *Environment, *Simulation analysis, *Methodology, Priorities, Reservoirs, Projects, Evaluation, Constraints, Costs, Alternative planning, Decision making, Systems analysis, Natural resources, *Oregon.
Identifiers: *Trade-offs(Environment), *Environmental variables, *Willamette Basin(Ore), Environmental quality, *Public policy.

The search for an adequate methodology to quantify environmental trade-offs led to a simulation technique, the Priority Evaluator Technique (PET). The PET was applied to determine values and trade-off preferences for environmental variables related to a proposed reservoir project. The PET simulates real world situations and allows the respondents to evaluate their preferences within a fixed cost frameowork. It systematically checks the respondent's perception of the existing conditions and compares the changes sought. From the responses obtained via interviewing, one can establish the extent to which respondents are satisfied with the prevailing conditions, the magnitude and direction of changes sought, the quality trade-offs, and the relative value of different situations. The PET is flexible and can accommodate alternative planning decisions, prices, incomes, and end factors. The promise shown by this application of the PET should encourage further exploration and evaluation. (Bell-Cornell)
W77-06002

THE NEW YORK WILD, SCENIC AND RECREATIONAL RIVERS SYSTEM ACT,
Columbia Univ., New York. School of Law.
For primary bibliographic entry see Field 6E.
W77-06041

MURKY WATERS: PRIVATE CLAIMS TO DEEP OCEAN SEABED MINERALS,
For primary bibliographic entry see Field 6E.
W77-06043

CALIFORNIA--'SAVING THE COAST',
R. G. Healy.
In: Land Use and the States, p 64-102, The Johns Hopkins University Press, Washington, D. C., 1976.

Descriptors: *California, *Pacific Coast Region, *Land use, *Land management, Coasts, Beaches, Land development, Planning, Regulation, Permits, Legislation, Environment, Water pollution, Recreation, Seashores, Conservation, Energy, Air pollution, Thermal pollution.
Identifiers: *Coastal zone management, Coastal waters.

On November 7, 1972, California voters approved a citizen-originated proposal giving state and regional commissions control over most forms of construction along its entire coast. By 1976 these commissions must present an enforceable coastline plan to the legislature. In the interim, they have broad power to prevent or modify building in a zone extending from 3 miles offshore to 1000 yards inland from the water's edge. This article examines the conditions leading up to California Coastal Zone Conservation Act. These include a long-term increase in public demand for beach and other coastal recreation, and increased development on the coast resulting in limited access to beaches and increased pollution. The author also examines what has occurred during the first thirteen months under the new law, including how the commissions have decided such issues as density of beachside development, protection of the natural environment and energy facilities on the coast. Also related is the state commission director's vision of the ultimate coastline plan to be submitted to the 1976 legislature (Hilburn-Florida)
W77-06048

ACHIEVEMENTS IN MARINE CONSERVATION, I. MARINE PARKS,
International Union for Conservation of Nature and Natural Resources, Morges (Switzerland). Commission on Ecology.
For primary bibliographic entry see Field 5G.
W77-06049

POST CARACAS: STRIKING A BARGAIN FOR SETTLEMENT AT GENEVA,
Columbia Univ., New York. School of Law.
For primary bibliographic entry see Field 6E.
W77-06054

7. RESOURCES DATA

7B. Data Acquisition

SAMPLE COLLECTING APPARATUS,
Kabushiki Kaisha Hokushin Denki Seisakusho, Tokyo (Japan). (Assignee).
For primary bibliographic entry see Field 5A.
W77-05652

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
For primary bibliographic entry see Field 4A.
W77-05752

USE OF THE RADIOISOTOPIC SAND TRACER (RIST) SYSTEM,
Coastal Engineering Research Center, Fort Belvoir, Va.
For primary bibliographic entry see Field 2L.
W77-05809

ALTERNATE METHODS OF AVALANCHE CONTROL (INTERIM) (1974-1975),
Washington Univ., Seattle. Geophysics Program; and Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W77-05810

HYDROGEOLOGICAL INVESTIGATIONS IN THE PAMPA OF ARGENTINA,
Bundesanstalt fuer Bodenforschung, Hanover (West Germany).
For primary bibliographic entry see Field 4B.
W77-05813

DELINEATION OF THERMAL EFFLUENTS DISCHARGED INTO TROPICAL WATERS AROUND PUERTO RICO BY AERIAL INFRARED SCANNING,
Puerto Rico Nuclear Center, Mayaguez.
For primary bibliographic entry see Field 5B.
W77-05814

EFFICIENCY TEST ON FOUR HIGH-SPEED PLANKTON SAMPLERS,
Institute of Marine Research, Bergen (Norway).
H. Bjorke, O. Dragesund, and O. Ulltang.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 183-200, 13 tab, 25 ref.

Descriptors: Population, *Sampling, Larvae, *Plankton, Surveys.

The catching efficiency of four high-speed plankton samplers (the BCF Bongo .03, the Hydrobios Bongo, the Clarke-Bumpus plankton sampler, and the Dutch version of the Gulf III sampler) were compared in order to recommend the most efficient gear in connection with extensive larval investigations on capelin in North Norway. Two types of hauls were made alternating with each other 6 times: the BCF Bongo, Hydrobios Bongo,

and Clarke-Bumpus sampler were attached to the same wire 3 m apart and towed at 3 kn; the Dutch-Gulf III sampler was towed separately at 5 kn. This test showed that the number of larvae caught with DGII was significantly larger than those caught with other gears. Comparison of the number of larvae and the volume of plankton caught with the different gears showed that the larvae seemed to avoid the BCF Bongo and the Hydrobios Bongo more than the DGIII. Both larvae and plankton seemed to avoid the Clarke-Bumpus sampler. (See also W77-05821) (Chilton-ORNL)
W77-05836

ON THE RELIABILITY OF METHODS FOR QUANTITATIVE SURVEYS OF FISH LARVAE,
Kiel Univ. (West Germany). Institut fuer Meereskunde.
K. Schnack.
In: The Early Life History of Fish, Vol. I, 1974. Proceedings of an International Symposium held at the Dunstaffnage Marine Research Laboratory, Oban, Scotland, May 17-23, 1973. p 201-212, 7 fig, 1 tab, 24 ref.

Descriptors: Population, *Sampling, *Larvae, Plankton, On-site investigations, Efficiencies, Fish populations.

Results from studies on the efficiency of Bongo high-speed plankton samplers and modified models of Gulf III samplers are presented. It is stated that the accuracy of quantitative plankton sampling depends on knowledge of the sampling efficiency of the gear, which again depends on filtration efficiency, avoidance and extrusion, and also on handling. Initial filtration efficiency of the Bongo and Gulf III nets is said to be close to 100%. Mean filtration efficiency during the tow is problematic, as clogging effects each of the samplers to a different degree. Evidence indicates fish larvae avoid even high-speed samplers where there is reduced filtration efficiency. Experiments with different mouth apertures show that there is no avoidance if there is complete filtration efficiency. The effect of extrusion must be established separately for each gear and for speed, allowing for clogging. This factor is of primary importance in determining the accuracy of quantitative sampling of fish larvae. (See also W77-05821) (Chilton-ORNL)
W77-05837

SIMPLIFIED TECHNIQUES FOR DETERMINING WATER CONDUCTING AND WATER STORAGE PROPERTIES OF SOILS,
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 2G.
W77-05853

AN EVALUATION OF SOME FLUORESCENT DYES FOR WATER TRACING,
Bristol Univ. (England). Dept. of Geography.
P. L. Smart, and I. M. S. Laidlaw.
Water Resources Research, Vol. 13, No. 1, p 15-33, February 1977. 19 fig, 11 tab, 77 ref.

Descriptors: *Fluorescent dye, *Water chemistry, *Tracers, *Dyes, Water, Amino acids, Rhodamine, Laboratory tests, Toxicity, Filters, On-site tests.
Identifiers: *Water tracing, *Amino G acid, Photine CU, Fluorescein, Lissomine FF, Pyranine, Rhodamine WT, Sulpho rhodamine B, Dye fluorescence.

Eight fluorescent dyes (amino G acid, photine CU, fluorescein, lissamine FF, pyranine, rhodamine B, rhodamine WT, and sulpho rhodamine B) were compared in laboratory and field experiments to assess their utility in quantitative tracing work. The properties considered included sensitivity and minimum detectability, the effect of water chemistry on dye fluorescence, photochemical and biological decay rates, adsorption losses on equipment and sediments, toxicity to man and aquatic organisms, and cost. The orange fluorescent dyes are more useful than the blue and green dyes because of the lower background fluorescence at the orange wave band, which permits higher sensitivities to be obtained. Pyranine fluorescence is strongly affected by pH over the range encountered in natural waters, which precludes its simple use in quantitive work. Amino G acid, photine CU, pyranine, and fluorescein all have high photochemical decay rates. Pyranine, lissamine FF, and amino G acid are the dyes most resistant to adsorption, but rhodamine WT, fluorescein, and sulpho rhodamine B also have moderately high resistance. Rhodamine B is readily adsorbed by most materials. Rhodamine WT (orange), lissamine FF (green), and amino G acid (Blue) are the three tracer dyes recommended. These 3 dyes can be used simultaneously to trace three injection sites with the filter combinations suggested. (Roberts - ISWS)
W77-05950

SEASONAL STREAMFLOW ESTIMATION IN THE HIMALAYAN REGION EMPLOYING METEOROLOGICAL SATELLITE SNOW COVER OBSERVATIONS,
National Aeronautics and Space Administration, Greenbelt, MD. Goddard Space Flight Center.
For primary bibliographic entry see Field 2C.
W77-05956

EVAPOTRANSPIRATION OF A DOUGLAS FIR DETERMINED WITH A WEIGHING LYSIMETER,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 2D.
W77-05959

MORPHOMETRIC DEFINITIONS AND CLASSIFICATIONS OF OXBOW LAKES, YUKON RIVER BASIN, ALASKA,
Indiana Univ.-Purdue Univ. at Indianapolis. Dept. of Geology; and Indiana Univ.-Purdue Univ. at Indianapolis. School of Science.
For primary bibliographic entry see Field 2H.
W77-05962

SOIL WATER REGIMES NEAR POROUS CUP WATER SAMPLERS,
Arizona Univ., Tucson. Dept. of Soils, Water, and Engineering.
For primary bibliographic entry see Field 2G.
W77-05964

A NOTE ON PLEXIGLAS HS FLUMES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W77-05965

U-TUBE OXYGENATION FOR ECONOMICAL SATURATION OF FISH HATCHERY WATER,
New Mexico State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W77-06023

7C. Evaluation, Processing and Publication

WATER QUALITY INFORMATION STORAGE AND RETRIEVAL SYSTEM FOR HAWAII, FINAL REPORT, PHASE I AND II, (JULY 1971-OCTOBER 1973),
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 5A.
W77-05672

WATER QUALITY INFORMATION STORAGE AND RETRIEVAL SYSTEM FOR HAWAII, PHASE III: FINAL REPORT, (NOVEMBER 1973-SEPTEMBER 1974),
Hawaii Univ., Honolulu. Water Resources Research Center.
For primary bibliographic entry see Field 5A.
W77-05673

FLOOD PLAIN MANAGEMENT THROUGH ALLOCATION OF LAND USES -- A DYNAMIC PROGRAMMING MODEL,
Illinois Univ. at Urbana-Champaign. Inst. for Environmental Studies.
For primary bibliographic entry see Field 6F.
W77-05720

A STRUCTURAL-FUNCTIONAL ANALYSIS OF THE SOCIO-POLITICAL SYSTEM RELATIVE TO WATER AND RELATED LAND RESOURCES IN THE COASTAL ZONE OF SOUTH CAROLINA,
Clemson Univ., S. C. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W77-05722

A STOCHASTIC APPROACH TO SPACE-TIME MODELING OF RAINFALL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2A.
W77-05730

COMPUTER SIMULATION OF SNOWMELT,
Arizona Univ., Tucson. School of Renewable Natural Resources.
For primary bibliographic entry see Field 2C.
W77-05735

EROSIONAL LANDFORM MAP OF THE REDWOOD CREEK DRAINAGE BASIN, HUMBOLDT COUNTY, CALIFORNIA, 1947-74,
Geological Survey, Menlo Park, Calif. Water Resources Div.
K. M. Nolan, D. R. Harden, and S. M. Colman.
Water-Resources Investigations 76-42 (Open-File Report), July 1976. 1 sheet, 1 map, 13 ref.

Descriptors: *Erosion, *Land forming, *Mapping, *Clear-cutting, *California, Floods, Runoff, Bank erosion, Sediment transport, Accelerated erosion, Landslides, Mass wasting, Geomorphology, Maps.
Identifiers: *Redwood Creek drainage basin(Calif).

Landslides and actively eroding stream channels disrupt roads, damage valuable timberland, and increase stream sediment loads in northwestern California. This 1:62,500 photointerpretative map shows the distribution of ten common types of fluvial and mass-movement erosional landforms in the drainage basin of Redwood Creek in 1947 and 1974. The mapped landforms include slides, slumps, large compound earthflows, debris avalanches, unstable streambanks and adjacent hillslopes, small mass-movement features, questionable or inactive landslides, deeply incised amphitheater shaped drainage basins, small actively eroding water courses, and actively eroding main channel stream banks. The map legend describes these landforms and the techniques used in preparing the map. The amount and diversity of erosional activity increased greatly between 1947 and 1974. This increased activity apparently reflects major floods in 1953, 1955, 1964, and 1972, as well as the start of large scale, tractor-yarded clearcut timber harvest in the basin. (Woodard-USGS)
W77-05742

WATER TEMPERATURES OF KENTUCKY,
Geological Survey, Louisville, Ky. Water Resources Div.
J. S. Zogorski, and J. L. Kiesler, Jr.
Water-Resources Investigations 76-86 (Open-File Report), November 1976. 1 sheet, 10 ref.

Descriptors: *Water temperature, *Streams, *Kentucky, *Maps, Sites, Data collections, Average.
Identifiers: *Annual temperature cycle, Maximum water temperatures, Minimum water temperatures.

The U.S. Geological Survey in cooperation with the Kentucky Geological Survey has been gathering temperature data on streams throughout Kentucky under a number of different programs for several decades. Periodic water temperature observations, which were made at a frequency of approximately once per month during the past 15 years, were analyzed with the aid of a computer program to describe the annual water temperature cycle at sites in the Commonwealth. Shown on a map of Kentucky, at each site of water-temperature collections, are maximum median monthly temperature, minimum median monthly temperature, and annual average temperature. Stream temperatures in Kentucky vary between 0 and 30 degrees Celsius (deg C) during the year. Maximum median monthly water temperatures occur in July and are typically between 23 and 27 deg C, whereas minimum median monthly water temperatures are recorded in January and are useually within the 2 to 6 deg C range. Annual average water temperatures are between 10 and 18 deg C. (Woodard-USGS)
W77-05743

BASIC DATA ON URBAN STORM-WATER QUALITY, PORTLAND, OREGON,
Geological Survey, Portland, Oreg. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05744

WATER-RESOURCES DATA COLLECTED IN THE DEVILS HOLE AREA, ASH MEADOWS, NEVADA, 1975-76,
Water Resources Div. Carson City, Nev. Geological Survey.
W. T. Hanes.
Open-file report 76-797, 1976. 15 p, 7 fig, 1 tab, 5 ref.

Descriptors: *Surface-groundwater relationships, *Water wells, *Pumping, *Springs, *Nevada, Water levels, Water level fluctuations, Hydrologic data.
Identifiers: *Devils Hole area(Nev).

The U.S. Geological Survey collected water-level, spring-flow, and power-consumption data in the Devils Hole area in Nevada from July 1975 through June 1976. The work for this sfurth annual data report was done in cooperation with the National Park Service. Continuous recorders were used to monitor water levels in Devils Hole, three observation wells, and the flow from four springs. Also, monthly readings were made on two wells to help define a general trend of ground-water levels. Monthly meter readings of six electrically powered irrigation wells provided a record of power consumption, which in turn, is an index of the amount of water pumped. The purpose of the work is to observe the effects, if any, of groundwater withdrawals from specified irrigtion wells in the Ash Meadows area on (1) the water level in Devils Hole, and (2) the flow of four springs in the area. Fairbanks Spring and Big Spring, which are in the extreme northern and southern parts of Ash Meadows respectively, show little effect of pumping. An increase in the monthly average flow at Fairbanks Spring in September can be attributed to runoff and surficial recharge in the surrounding area caused by a large cloudburst. Jack Rabbit Spring, which is about 1 mile southwest of the major pumping field, is affected strongly by pumping. Jack Rabbit Spring flowed during the winter months but flowed very infrequently during nonwinter months. Point of Rocks Spring had a flow pattern similar to Big Spring and Fairbanks Spring. All the springs had a general increase in flow during the Winter months. (Woodard-USGS)
W77-05745

GEOLOGIC EVALUATION OF WASTE-STORAGE POTENTIAL IN SELECTED SEGMENTS OF THE MESOZOIC AQUIFER SYSTEM BELOW THE ZONE OF FRESH WATER, ATLANTIC COASTAL PLAIN, NORTH CAROLINA THROUGH NEW JERSEY,
Geological Survey, Raleigh, N.C. Water Resources Div.
For primary bibliographic entry see Field 5B.
W77-05753

COMPOSITION OF SELECTED RAIN SAMPLES COLLECTED AT MENLO PARK, CALIFORNIA IN 1971,
Geological Survey, Menlo Park, Calif. Water Resources Div.
V. C. Kennedy, G. W. Zellweger, and R. J. Avanzino.
Open-File Report 76-852, November 1976. 7 p, 2 tab.

Descriptors: *Rain water, *Chemical analysis, *Data collections, *California, Chemical properties, Sampling, Chlorides, Trace elements, *California.
Identifiers: *Menlo Park(Calif).

Chemical analysis are tabulated for 104 rain samples that were collected at Menlo Park, California, during November and December 1971. Of the 13 constituents determined, chloride was the most prominent with a range from less than 0.1 to 15.0 mg/liter. (Woodard-USGS)
W77-05754

PREDICTED EFFECTS OF A PROPOSED WATER-RESOURCE MANAGEMENT PLAN IN THELOWER SAN LUIS REY RIVER VALLEY, CALIFORNIA, USING DIGITAL GROUND-WATER FLOW MODELS,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 4B.
W77-05755

INDEX OF SURFACE-WATER STATIONS IN TEXAS, OCTOBER 1976,
Geological Survey, Austin, Tex.
Texas District Report, 1976. 20 p, 1 plate, 2 tab.

Descriptors: *Indexing, *Surface waters, *Data collections, *Sites, *Texas, Gaging stations, Reservoir storage, Flood data, Low flow, Crest-stage gages, Tides, Water quality, Chemical analysis, Organic compounds, Pesticides, Sediment transport, Biological properties.

This index of surface-water stations shows the station number and name, type of data collected, and the office principally responsible for the data collection. A permanent numerical designation for gaging stations had been adopted on a nationwide basis; stations are numbered and listd in downstream order. As of October 1, 1976, 460 stream-gaging, 80 reservoir-content, 13 stage, 68 flood-hydrograhy partial-record, 12 flood-profile partial-record, 84 low-flow partial-record, 13 crest-stage partial-record, 57 tide-level, 121 daily chemical-quality, 30 continuous-recording water-quality, 224 peridoic chemical-quality, 168 peridic organic-quality, 121 pesticides, 5 sediment, 37 periodic sediment, 81 periodic biological, and 64 reservoir-inventory stations were in operation. (Woodard-USGS)
W77-05760

COMPUTATIONAL HYDRAULICS: A SHORT PATHOLOGY,
Danish Hydraulic Inst., Copenhagen. Computational Hydraulics Center.
For primary bibliographic entry see Field 8B.
W77-05797

A DESCRIPTIVE CATALOGUE OF THE AUSTRALIAN REPRESENTATIVE BASINS 1975.
Department of National Resources, Canberra (Australia).
For primary bibliographic entry see Field 4D.
W77-05816

HYDROGEOLOGY OF THE FOREMOST AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05817

HYDROGEOLOGY OF THE VERMILION AREA, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05818

HYDROGEOLOGY OF THE EDMONTON AREA (NORTHEAST SEGMENT), ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05819

HYDROGEOLOGY OF THE TRI-CREEK BASIN, ALBERTA,
Research Council of Alberta, Edmonton.
For primary bibliographic entry see Field 4B.
W77-05820

AN APPLICATION OF THE UTAH STATE UNIVERSITY WATERSHED SIMULATION MODEL TO THE ENTIAT EXPERIMENTAL WATERSHED, WASHINGTON STATE,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 4D.
W77-05918

DISCRETE REPRESENTATION OF STORAGE FOR STOCHASTIC RESERVOIR OPTIMIZATION,
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.; and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
For primary bibliographic entry see Field 4A.
W77-05921

SHOT NOISE MODELS FOR THE GENERATION OF SYNTHETIC STREAMFLOW DATA,
Tel-Aviv Univ. (Israel). Dept. of Statistics.
For primary bibliographic entry see Field 2E.
W77-05955

A WATER MANAGEMENT MODEL FOR HIGH WATER TABLE SOILS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 2G.
W77-05983

COUPLED OPTIMIZATION-SIMULATION WATER QUALITY MODEL,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 5B.
W77-05992

EXTENDED PERIOD SIMULATION OF WATER SYSTEMS--PART B,
Systems Control, Inc., Palo Alto, Calif.

For primary bibliographic entry see Field 4A.
W77-05996

MULTISTATION, MULTIYEAR SYNTHESIS OF HYDROLOGIC TIME SERIES BY DISAGGREGATION,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2A.
W77-06008

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN ENVIRONMENTAL DISPERSION MODELS,
Cleveland State Univ., Ohio.
For primary bibliographic entry see Field 2A.
W77-06010

THE EFFECT OF COAL SURFACE MINING ON THE WATER QUALITY OF MOUNTAIN DRAINAGE BASIN STREAMS,
Tennessee Univ., Knoxville. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-06012

TIME RESOLUTION OF THE HYDROLOGIC TIME-SERIES MODELS,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
For primary bibliographic entry see Field 2E.
W77-06013

8. ENGINEERING WORKS

8A. Structures

ICINGS ALONG THE TRANS-ALASKA PIPELINE ROUTE,
Geological Survey, Anchorage, Alaska. Water Resources Div.
For primary bibliographic entry see Field 2C.
W77-05741

8B. Hydraulics

DISPERSION PROCESSES IN CIRCULAR OPEN-CHANNEL FLOWS,
Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil and Environmental Engineering.
A. M. Oguntuase.
Ph D Thesis, October 1976. 403 p. 82 fig, 56 tab, 135 ref, 3 append. OWRT A-027-NJ(7).

Descriptors: *Open channel flow, Sewers, Hydrodynamics, Diffusion, *Dispersion, Turbulent flow, *Mathematical models, Numerical analysis, *Simulation analysis, Computer models, *Pipe flow.
Identifiers: *Sewer flows, *Dispersion-Diffusion Coefficients, Turbulent diffusion, Finite difference equations.

The objective was to simulate, through mathematical modeling and laboratory experimentation, hydrodynamic and dispersion processes in partially-full pipe flows, descriptive of sewer flows. In theoretical phase of the work, equations of motion and species balance mass transport for a pollutant were derived, with appropriate boundary conditions, applicable to free surface flows with circular geometry. Momentum equation for turbulent flow was solved numerically under steady-state conditions to obtain cross-sectional time-averaged velocity profiles. Resulting elliptical partial-differential equations, with mixed boundary conditions were expressed in finite-difference forms and solved by modified successive over-relaxation (SOR) method. Turbulent diffusion coefficients were estimated through selection of appropriate parameters which insure nonzero values at air-water interface and define the profiles of the space-variable coefficients. Species mass transport equations were solved for three-dimensional cases of longitudinal convection with lateral and vertical diffusion. Input velocity profiles were generated either directly from the turbulent diffusivity-velocity model, which formed the first part of the overall dispersion model, or supplied as external inputs from experimental measurements or empirical expressions. The numerical scheme involved three computational steps describing the three simultaneous processes of longitudinal convection, vertical diffusion, and lateral diffusion in sequence within a given time interval. Laboratory measurements in a three-inch circular flume with a recirculating system provided data for comparison and verification of predictions from theoretical and numerical analyses. Measured velocity profiles were used to calibrate the momentum diffusivity model. Dispersion coefficients from logarithmic fit of experimental velocity were lower than those from the momentum diffusivity--a feature attributed to differing velocity gradients at points close to the wall. Velocity profiles were the most dominant factors in determining the magnitude of dispersion coefficient. A well defined logarithmic relationship between computed dispersion coefficient and mean square deviation of velocity was established. The developed numerical computer model provides adequate estimates of values of longitudinal dispersion coefficients suitable for circular open-channel and sewer flow analyses and design. (See also W77-02827 and W71-08496) (Bourodimos-Rutgers)
W77-05601

RIVER TURBINE,
For primary bibliographic entry see Field 4A.
W77-05660

FRICTION EFFECTS ON SPATIALLY VARIED OPEN CHANNEL FLOWS WITH INCREASING DISCHARGE,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
J. D. Lin, V. E. Scottron, and H. K. Soong.
In: Rivers '76, Symposium on Inland Waterways for Navigation, Flood Control and Water Diversions, Waterways, Harbors and Coastal Engineering Division of ASCE, August 10-12, 1976, Fort Collins, Colorado, Colorado State University, p. 1517-1534. 4 fig, 2 tab, 21 ref. OWRT A-051-CONN(3). 14-31-0001-3807.

Descriptors: *Open channel flow, *Discharge(Water), *Flow characteristics, *Model studies, Momentum equation, Energy equation, Manning equation, Energy loss.
Identifiers: *Spatially varied flow, *Friction effects, *Increasing discharge, *Turbulent mixing loss, Lateral inflow.

The fundamental analysis of spatially varied open channel flows is based on the energy and momentum principles. The assumptions that the velocity distribution is uniform across the channel section and that Manning's formula may be used to evaluate the frictional loss, which are conventionally used in one-dimensional flow analyis, are re-examined. By means of the energy and momentum balance analysis and with the aid of experimental data for spatially vaired flows with increasing discharge, it can be shown that the effect of the nonuniform flow field across the channel section is important and can be accounted for by the steamwise variation of energy and momentum fl correction factors. A new approach is introduced to deal with the energy loss in the energy equation by resolving it into two components: a friction loss for the boundary shear and a turbulent mixing loss for the crosss flow that exists implicitly in the one-dimensional flow analysis. These losses are found to be of the same order of magnitude. The mixing loss coefficient is derived as a function of the lateral discharge/total discharge ratio for open channel flows with lateral inflow from a side inlet channel. (de Lara-Connecticut)
W77-05674

THE INFLUENCE OF TURBULENCE ON STATIC AND TOTAL PRESSURE PROBES,
Connecticut Univ., Storrs. Inst. . of Water Resources.
V. E. Scottron.
In: Flow Measurement Symposium, February 23-25, 1977, Gaithersburg, Maryland, National Bureau of Standards. 17 p, 5 fig, 1 tab, 15 ref.

Descriptors: *Pitot tubes, *Turbulence, *Turbulent boundary layers, *Velocity, *Instrumentation, Laboratory tests.
Identifiers: *Static pressure probes, *Impact pressure probes, *Velocity measurements, *Hot-wire anemometer, Wind tunnel.

In the course of studying boundary layer flows over a rough boundary in an adverse pressure gradient in a wind tunnel, measurements of mean and turbulent velocities were taken using a hot-wire anemometer. Comparative velocity measurements were taken with static and impact probes attached to a micromanometer. Attempts have been made to determine the influence of the turbulence compounds on the readings obtained by these probes. Also comparisons have been made with the results of similar studies made by other investigators, such as Toomre, Bradshaw and de Haan. Used in these tests were 1/16 and 1/8 inch diameter separated probes. Combine probes could not be used near the wall due to the local pressure distribution caused by roughness. The boundary layer thicknesses were large, of the order of 10 to 12 inches so that it is possible to obtain a wide variation of turbulence levels by positioning of the probes. Pressure differences were referenced to a fixed static probe outside the boundary layer in a very low turbulence region. Pressure indications were sufficiently large that it was possible to obtain reasonable verification of the theoretical estimates obtained by Toomre.
W77-05676

SPILLWAYS WITH NOTCHED OVERFLOW EDGE (VODOSLIVY S ZUBCHATOI PERELIVNOI KROMKOI),
G. P. Kuchin, and I. A. Evstigneev.
Bumazhnaya Promyshlennost, No. 10, p 23-24, October, 1976. 2 fig.

Descriptors: *Spillways, *Treatment facilities, *Settling basins, Waste water treatment, Hydraulic structures, Overfalls.

A brief description is given of a spillway for sedimentation tanks with a notched instead of a smooth overflow edge. This spillway is mounted on the internal wall of the catch basin and assures a more uniform collection of the clarified water. An example is given of the calculation of the number of notches per meter and the pressure head as a function of the diameter of the sedimentation tank and the flow rate of clarified water. (Stapinski-IPC)
W77-05718

EMERGING NAPPE SUBJECT TO FLUCTUATING UNDERPRESSURES,
Toronto Univ. (Ontario).
G. D. Ransford.
Journal of Hydraulic Research/Journal de Recherches Hydrauliques, Vol. 14, No. 4, p 287-292, 1976. 4 fig, 1 tab, 1 ref.

Descriptors: *Jets, *Velocity, *Potential flow, *Fluctuations, Spillways, Outlet works, Pressure, Analysis, Hydrodynamics, Weirs.
Identifiers: *Fluctuating pressure, *Weir nappes, *Oscillations, Broadcrested weirs, Underpressure.

The effects of small sinusoidal pressure fluctuations on a nappe springing clear of a broadcrested weir were analyzed, with particular reference to fluctuations in local and average velocity of the emerging nappe. Reference was made to the effects of pressure fluctuations measured during flutter experiments on a full-scale dam, and numerical values were given for this case. (Adams-ISWS)
W77-05796

COMPUTATIONAL HYDRAULICS: A SHORT PATHOLOGY,
Danish Hydraulic Inst., Copenhagen. Computational Hydraulics Center.
M. B. Abbott.
Journal of Hydraulic Research/Journal de Recherches Hydrauliques, Vol. 14, No. 4, p 271-285, 1976. 6 fig, 1 tab, 14 ref.

Descriptors: *Mathematical models, *Hydraulics, *Numerical analysis, *Computer models, Rivers, Estuaries, Harbors, Equations, Analytical techniques, Model studies.
Identifiers: *Errors, Conservation equations, Error propagation, Computational dispersion.

Some of the errors that commonly occur in many of the computational models currently used in hydraulic research and engineering were mentioned and discussed. The simulation of transport and dispersion, using difference schemes, was shown to give rise to problems of pseudo-dispersion and pseudo-radiation, mass falsification, and other violations of physical laws. Several of these problems carry over to nearly horizontal flow simulations, and these too were illustrated. Corresponding problems in related fields were then introduced. Difficulties and errors arise not only in the models themselves, but also in their applications. Unless the entire investigation operation functions correctly, the consequences of these errors can be very serious in engineering practice. Finally, the need for more education in this area was emphasized. (Adams-ISWS)
W77-05797

PREDICTING DISPERSION COEFFICIENT OF STREAMS,
Missouri Univ.-Columbia. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05803

NUMERICAL MODEL OF STRATIFIED ESTUARY FLOWS,
International Course in Hydraulic Engineering, Delft (Netherlands).
For primary bibliographic entry see Field 2L.
W77-05804

NUMERICAL PUMPING TEST ANALYSIS IN UNCONFINED AQUIFERS,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W77-05805

TRANSIENT FINITE ELEMENT SHALLOW LAKE CIRCULATION,
Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W77-05806

ADVANCED METHODOLOGIES FOR DESIGN OF STORM SEWER SYSTEMS,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W77-05927

A NOTE ON PLEXIGLAS HS FLUMES,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5A.
W77-05965

TRANSIENT HEAT RELEASES FROM OFFSHORE NUCLEAR PLANTS,
Massachusetts Inst. of Tech. Cambridge. Energy Lab.
For primary bibliographic entry see Field 5B.
W77-05967

ANALYSIS OF FLOWS WITH INITIALLY UNKNOWN DISCHARGE,
Technische Universitaet, Dresden (East Germany). Section of Water Science and Engineering.
H-J. Diersch, A. Schirmer, and K-F. Busch.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 103, No. HY3, Proceedings Paper No. 12784, p 213-232, March 1977. 11 fig, 37 ref, 2 append.

Descriptors: *Free surfaces, *Finite element analysis, *Discharge coefficient, *Flow profiles, *Spillway crests, Spillways, Spillway gates, Computer models, Hydraulics, Mathematical models, Discharge(Water).
Identifiers: Gravity flow, Convergence.

Two-dimensional and axisymmetric gravity flows of ideal fluids were calculated by means of the finite element method. A generalized iteration technique was used for the discharge and free-surface determinations. The model can be employed in a versatile manner due to a flexible network structure. Significant principles for the control of the entire network movement were presented for free-surface problems. This yeilds, apart from theoretical discharge coefficients, the free-surface profiles and the velocity and pressure distributions over the entire flow domain. Solutions for flow under sluice gates, under a spillway gate, over spillway crests, and over a morning-glory shaft spillway were given. (Adams-ISWS)
W77-05968

WAVE-INDUCED CIRCULATION IN SHALLOW BASINS,
Delaware Univ., Newark. Dept. of Civil Engineering.
R. A. Dalrymple, R. A. Eubanks, and W. A. Birkemeier.

Descriptors: *Waves(Water), *Currents(Water), *Circulation, Analysis, Laboratory tests, Model studies, Coastal engineering, Ocean currents, Equations, Mathematical studies, Basins, Shallow water.
Identifiers: *Longshore currents, Wave energy.

Water waves in model basins were used to study longshore currents on beaches. Due to the limited length of basins, return flows are engendered which are not representative nature. Using a simplified analytical theory, the transport stream function for three common model basin setups was found. Verification of the major features of the stream function was carried out in a small wave tank. Conclusions concerning adequate basin sizes to model longshore currents were made (Adams - ISWS)
W77-05970

VERTICAL DIFFUSIVITIES IN AREALLY AVERAGED MODELS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W77-05997

SURGE EFFECTS FROM HURRICANE ELOISE,
Army Engineer District, Mobile, Ala. Navigation and Coastal Branch.
For primary bibliographic entry see Field 2L.
W77-06085

BAY SPRINGS LAKE WATER QUALITY STUDY,
Army Engineer Waterways Experiment Station, Bicksburg, Miss.
For primary bibliographic entry see Field 5B.
W77-06087

8C. Hydraulic Machinery

EMERGING NAPPE SUBJECT TO FLUCTUATING UNDERPRESSURES,
Toronto Univ. (Ontario).
For primary bibliographic entry see Field 8B.
W77-05796

GETTING WATER FROM THE SUN,
Arizona Univ., Tucson. Dept. of Soils Water and Engineering.
For primary bibliographic entry see Field 3F.
W77-05937

8D. Soil Mechanics

TIME-DEPENDENT DEVELOPMENT OF STRENGTH IN DREDGINGS,
Northwestern Univ., Evanston. Ill. Technological Inst.
For primary bibliographic entry see Field 5G.
W77-05966

8G. Materials

THE INFLUENCE OF TURBULENCE ON STATIC AND TOTAL PRESSURE PROBES,
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 8B.
W77-05676

ICE ENGINEERING IN SMALL CRAFT MARINAS, AN ANNOTATED BIBLIOGRAPHY,
Wisconsin Univ.-Parkside, Kenosha. Dept. of Engineering Science.
For primary bibliographic entry see Field 2C.
W77-05812

THE LOK ON PAI DESALTING PLANT - HONG KONG,
For primary bibliographic entry see Field 3A.
W77-05940

8I. Fisheries Engineering

NITROGEN SUPERSATURATION: ONE MORE PERIL FOR SALMON AND STEELHEAD,
Washington State Water Research Center, Pullman.
Washington State's Water, A 1975 Report (1975), p. 17-21.

Descriptors: *Columbia River, *Hydroelectric power, Dams, Dam sites, Spillways, *Salmon, *Rainbow trout, *Supersaturation, Fish disease, Mortality, On-site investigations, Bulkhead gates, *Fish migration.
Identifiers: *Flip lip deflectors, *Slotted bulkhead gates, *Gas bubble disease.

The hazards to downstream migrant salmon and steelhead in their passage through and over the

hydroelectric dams in the Columbia River result in high mortality. Structural modifications for reducing air entrainment have been studied by the U.S. Army Corps of Engineers. These include slotted bulkheads in empty generator bays and 'flip lip' deflectors seen to have the most promise. (Katz)
W77-05768

PROGRESS REPORT, EVALUATION OF FISH PROTECTIVE FACILITIES AT LITTLE GOOSE DAM AND REVIEW OF OTHER STUDIES RELATING TO PROTECTION OF JUVENILE SALMONIDS IN THE COLUMBIA AND SNAKE RIVERS, 1973,
National Marine Fisheries Service, Seattle, Wash.
W. J. Ebel, R. W. Krcma, and H. L. Raymond.
Contract No. DACW68-71-0093, Corps of Engineers December, 1973, 53 p., 15 tab., 5 fig., 6 ref.

Descriptors: *Columbia River, *Salmon, Rainbow trout, Dams, Dam sites, On-site investigations, Juvenile fish, *Fish migrations, Anadromous fish, *Fish handling facilities, *Fish passages, Fish ladders, Supersaturation, Chinook salmon.
Identifiers: *Snake River, Little Goose Dam, Fish diversion, Fish marking, Fish transport.

The National Marine Fisheries Service continued an evaluation of fish protective facilities for juvenile salmonids at Little Goose Dam on the Snake River. Emphasis was placed on diverting, collecting, marking and transporting young salmonids for release below Bonneville Dam with appropriate control releases for evaluation of operations. In addition, recovery efforts continued on adult salmonids returning upriver and transport during juvenile migrations in 1971 and 1972. (Katz)
W77-05769

PROGRESS REPORT, EVALUATION OF FISH PROTECTIVE FACILITIES AT LITTLE GOOSE DAM AND REVIEW OF OTHER STUDIES RELATING TO PROTECTION OF JUVENILE SALMONIDS IN THE COLUMBIA AND SNAKE RIVERS, 1974,
National Marine Fisheries Service, Seattle, Wash., Northwest Fisheries Center.
W. J. Ebel, R. F. Krcma, D. L. Park, H. L. Raymond, and M. L. Slatick.
Sponsored by U.S. Army Corps of Engineers, Contract No. DACW 68-71-C-0093. December, 1974, 50 p., 17 tab., 7 fig., 3 append.

Descriptors: *Columbia River, Salmon, Rainbow trout, Dams, Dam sites, *Fish passages, *Fish migration, Juvenile fish, Fish hatcheries, Fish behavior, Anadromous fish, Nitrogen, Atmospheric gases, *Supersaturation, On-site investigations, *Chinook salmon, *Fish handling facilities.
Identifiers: *Snake River, *Fish protective facilities, Submerged traveling screens, Migration rates, *Fish survival.

National Marine Fisheries Service continued their evaluation of fish protective facilities for juvenile salmonids at Little Goose Dam on the Snake River. Recovery efforts were continued on adult salmonids returning after marking and transport during juvenile migration in 1971, 1972 and 1973. More than 800 marked adult steelhead trout and over 250 chinook salmon were recovered. Studies were continued on levels of dissolved gases in the Columbia and Snake Rivers in relation to river discharge and operational procedures. (Katz)
W77-05770

SUPERSATURATION OF THE WATER SUPPLY AND OCCURRENCE OF GAS BUBBLE DISEASE AT CULTUS LAKE TROUT HATCHERY,
British Columbia Univ., Vancouver, Inst. of Fisheries.
For primary bibliographic entry see Field 5C.
W77-05773

EFFECT OF JOHN DAY DAM ON DISSOLVED NITROGEN CONCENTRATIONS AND SALMON IN THE COLUMBIA RIVER, 1968,
Bureau of Commercial Fisheries, Seattle, Wash.
For primary bibliographic entry see Field 5C.
W77-05774

LEVELS OF NITROGEN SUPERSATURATION AT CHIEF JOSEPH DAM UNDER VARIOUS SPILL CONDITIONS, PHASE I,
Washington State Dept. of Fisheries, Olympia.
For primary bibliographic entry see Field 5C.
W77-05776

THE SNAKE RIVER SALMON AND STEELHEAD CRISIS, ITS RELATION TO DAMS AND THE NATIONAL ENERGY CRISIS,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-05781

EFFECT OF RELEASE LOCATION ON SURVIVAL OF JUVENILE FALL CHINOOK SALMON, ONCORHYNCHUS TSHAWYTSCHA,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
For primary bibliographic entry see Field 5C.
W77-05782

SNAKE RIVER RUNS OF SALMON AND STEELHEAD TROUT: TRENDS IN ABUNDANCE OF ADULT AND DOWNSTREAM SURVIVAL OF JUVENILES,
National Marine Fisheries Service, Seattle, Wash. Northwest Fisheries Center.
For primary bibliographic entry see Field 5C.
W77-05783

PASSAGE OF JUVENILE FISH THROUGH ORIFICES IN GATEWELLS OF TURBINE INTAKES AT MCNARY DAM,
Bureau of Commercial Fisheries, Seattle, Wash. Biological Lab.
W. W. Bentley, and H. L. Raymond.
Transactions of the American Fisheries Society, Vol. 98 (No. 4), 1969, p 723-727. 1 fig, 1 tab, 5 ref.

Descriptors: *Columbia River, *Dam, Dam sites, *Fish migration, Salmon, Rainbow trout, Mortality, Juvenile fish, Anadromous fish, *Fish passages, Fish ladders, Dam design, Chinook salmon.
Identifiers: *McNary Dam, *Ice and trash sluiceway.

Trials at McNary Dam on the Columbia River demonstrated that the passage of juvenile fish from turbine intake gatewells via the orifice into the ice and trash is a promising method of bypassing fish around turbines at dams. A comparison of the total losses now incurred by allowing the fish to pass through turbines will yield a meaningful evaluation of the desirability of transferring fish from gatewells to the ice and trash sluice. (Katz)
W77-06021

USE OF A RECOMPRESSION CHAMBER TO ALLEVIATE GAS-BUBBLE DISEASE IN COHO SAC-FRY,
New Hampshire Univ., Durham.
E. S. Adams, and F. G. Towle.
The Progressive Fish Culturist Vol 36 (1), January 1974, p 41.

Descriptors: *Supersaturation, Water supply, Artesian wells, Juvenile fish, *Fish disease, *Fish physiology, Trout, *Hydrostatic pressure, Agriculture.
Identifiers: Nitrogen supersaturation, *Gas bubble disease, *Yolk-sac fry, Saturation table, *Recompression chamber, *Coho salmon.

Experiments indicated that a recompression chamber is a possible cure for nitrogen supersaturation disease in fish. Descent at approximately 10 feet per minute should be followed by a gradual ascent according to a saturation schedule. (Katz)
W77-06028

BONNEVILLE SPILLWAY NITROGEN TESTS, 29-30 OCTOBER 1972 TEST RESULTS,
Corps of Engineers, Portland, Oreg. Hydraulic Design Section.
H. P. Tervooren.
9 January 1973, 8 p, 1 fig.

Descriptors: Nitrogen, *Supersaturation, Atmospheric gas, *Columbia River, *Bonneville dam, *Spillways, Hydraulic engineering, *Dams, Water quality, Hydraulic structures, On-site investigations, Hydroelectric plants, Forebays.
Identifiers: *Bonneville spill conditions, Nitrogen supersaturation, *Forebay nitrogen, Corps of engineers.

The tests of 15 November 1972 confirm the conclusions that deflectors in all bays at Bonneville Dam would reduce excess nitrogen in the spillway fall water by 50%. It is reasonable to anticipate that for future Bonneville spill conditions with 100% forebay conditions the nitrogen content would not exceed 110% if deflectors are installed. (Katz)
W77-06029

FINAL REPORT, THE EFFECT OF SPILLWAY FLOW DEFLECTORS AT BONNEVILLE DAM ON TOTAL GAS SUPERSATURATION AND SURVIVAL OF JUVENILE SALMON,
National Marine Fisheries Service, Seattle, Wash.
For primary bibliographic entry see Field 5C.
W77-06030

EVALUATION OF ALTERNATIVE FISH BARRIER SYSTEMS FOR PILGRIM NUCLEAR POWER STATION,
Yankee Atomic Electric Co., Westborough, Mass. Environmental Sciences Group.
S. C. Doret, R. A. Marcello, Jr., and R. B. MacPherson.
Submitted to Boston Edison Company, Boston, Massachusetts, YAEC-1116, September 1976. 36 p, 8 fig, 5 ref.

Descriptors: *Fish barriers, Environmental controls, Mortality, Sea water, Fish migration, Fish passages, *Fish repellants, *Fishing gear, On-site investigations, Engineering structures, Discharge lines, Fish diseases, *Supersaturation, Atmospheric gases, Operations.
Identifiers: Pilgrim Nuclear Power Station, *Fish nets, Sloped-side screens, Rectangular vertical screens, Angled screens, Discharge canal, Menhaden, *Nitrogen supersaturation.

The objective was to determine the feasibility of installing various fish barrier alternatives at Pilgrim Nuclear Power Station. The design objectives and requirements of a fish barrier were defined and categorized as environmental engineering, and operational and maintenance considerations. The specific fish barrier alternatives considered include: fish nets, sloped-side screens, rectangular vertical screens, angled screens, moving mesh barriers, and louvers. Of these fish barrier alternatives, only two fish nets and sloped-side screens were considered practical for installation at Pilgrim Station. Based on a comparative evaluation of these two fish barrier alternatives, the preferred fish barrier system for installation in the Pilgrim Station discharge canal is the fish net system. (Katz)
W77-06032

CHIEF JOSEPH SPILLWAY NITROGEN ENTRAINMENT, TEST OF 17 NOVEMBER, 1972,
R. Ross.

Presented at Nitrogen Task Force Meeting, North Pacific Division, Corps of Engineers, 11 January 1973. 20 p, 5 tab., 8 fig.

Descriptors: *Columbia River, Grand Coulee Dam, *Supersaturation, Atmospheric gases, Hydroelectric power, Spillway, Water quality, Engineering structures, Dam sites, Hydraulics, *Mixing, *Equilibrium.
Identifiers: *Chief Joseph Dam, *Supersaturated water, *Lateral mixing, Chief Joseph Forebay, *Nitrogen entrainment.

Gas supersaturation will occur in Chief Joseph Forebay at least every other year, between March and mid-August. Equilibration of supersaturated water below the dam is rapid and is reduced by approximately half within 7.2 miles. Lateral mixing of the rivers of water happens slowly. (Katz)
W77-06099

SOURCES OF GAS SUPERSATURATION IN WATER,
Corvallis Environmental Research Lab., Oreg.
For primary bibliographic entry see Field 5B.
W77-06100

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

CALIFORNIA WATER RESOURCES CENTER, ANNUAL REPORT, JULY 1, 1975-JUNE 30, 1976,
California Univ., Davis. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-265 092, Price codes: A06 in paper copy, A01 in microfiche. Report No. 37, October 1976. 106 p. OWRT A-999-CAL(13).

Descriptors: *Research and Development, Water resources, *California, *Water Resources Institute, Education, Universities, *Projects.

The principal investigators of fresh water projects sponsored by the California Water Resources Center have submitted their annual reports, from which the most essential information has been abstracted to form this narrative section. The individual narratives have been purposely kept brief. Each emphasized, wherever possible, the 'hard' results and the actual or potential applications of those results to benefit affected interests. Shown also are starting and scheduled ending dates for each research project. The reader may infer from these the relative degree of progress achieved to date, together with an indication of when further information might become available--usually at least six months after completion of the project for any detailed account. The Report covers both State of California and Federally funded research activities.
W77-05736

9D. Grants, Contracts, and Research Act Allotments

CALIFORNIA WATER RESOURCES CENTER, ANNUAL REPORT, JULY 1, 1975-JUNE 30, 1976,
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 09A.
W77-05736

ASSESSING PROGRAM IMPACT--WATER RESOURCES PLANNING ACT, TITLE III,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 06E.
W77-05989

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

FLORIDA WATER RESOURCES LAW, A BIBLIOGRAPHY,
Office of Water Research and Technology, Washington, D. C.
For primary bibliographic entry see Field 06E.
W77-05670

ICE ENGINEERING IN SMALL CRAFT MARINAS, AN ANNOTATED BIBLIOGRAPHY,
Wisconsin Univ.-Parkside, Kenosha. Dept. of Engineering Science.
For primary bibliographic entry see Field 02C.
W77-05812

A BIBLIOGRAPHY OF SOVIET LITERATURE ON FRESHWATER HYDROBIOLOGY AND RELATED PROBLEMS FOR 1975: PART 20, (IN RUSSIAN),
For primary bibliographic entry see Field 05B.
W77-05854

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ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W77-05983 06091--06098	9
Cornell University, Policy Models for Water Resources Systems	W77-05669 05918--05926 05978--05981 05992--05996	19
ERDA Oak Ridge National Laboratory, Nuclear Radiation and Safety	W77-05821--05850	30
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W77-05987	1
Illinois State Water Survey, Hydrology	W77-05788--05810 05812--05820 05950--05951 05953--05959 05961--05970 05972--05977 05997--06004 06006 06008--06015	74
Institute of Paper Chemistry, Water Pollution from Pulp and Paper Industry	W77-05677--05686 05689--05718	40
University of Arizona, Arid Land Water Resources	W77-05936--05937 05940--05949 05982 05988--05991	17
University of Florida, Eastern U. S. Water Law	W77-06041--06089	49
University of Wisconsin, Eutrophication	W77-05984	1

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B. STATE WATER RESOURCES RESEARCH INSTITUTES	W77-05601--05605 05671--05676 05720--05726 05728--05737 05851--05853 05928--05935 06016	40
C. OTHER		
BioSciences Information Service	W77-05606--05607 05643, 05662 05687--05688 05719, 05727 05811, 05854 05878, 05898 05938--05939 05952, 05960 05971, 05986 06005, 06007 06019, 06031 06033, 06090	24
Biological Consultant and Information Services (Effects of Pollutants on Aquatic Life)	W77-05608--05642 05644--05651 05856--05877 05879--05897 05899--05917	103
Biological Consultant and Information Services (Gas Bubble Disease)	W77-05763--05787 06018 06020--06030 06032 06034--06040 06099--06100	47
Ocean Engineering Information Service (Patents)	W77-05652--05661 05663--05668	16
Office of Water Research and Technology	W77-05670, 05927 06017	3
U. S. Geological Survey	W77-05738--05762	25

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